DOCUMENT RESUME

ED 123 033 SE 019 073

AUTHOR	McDougall, Christina, Ed.
TITLE	Technology and Development. UNITAR News Volume 6 Number 4.
INSTITUTION	United Nations, New York, N. Y. Inst. for Training and Research.
PUB DATE	74
NOTE	51p.; Small type used in footnote information
AVAILABLE FROM	UNITAR News, 801 United Nations Plaza, New York, New York 10017 (free; 2-9 copies, $1.00 ea.; 10-24 copies, $0.[illegible] ea.; 25-99 copies, $0.60 ea.; 100-300 copies, $0.50 ea.; over 300 copies, $0.30 ea.; postage and handling additional)
EDRS PRICE	MF-$0.83 HC-$3.50 Plus Postage
DESCRIPTORS	*Developing Nations; *Development; *Energy; *International Organizations; Science Education; Science Programs; *Technology
IDENTIFIERS	*United Nations

ABSTRACT

In this UNITAR News issue are surveyed some of the elements of technological change and their effect on development. The key issues are presented in digest form to stimulate questions, disseminate ideas, and present a range of opinions. Included in this issue is a chart showing the various bodies, committees, and commissions comprising the United Nations Economic and Social Council. (LS)

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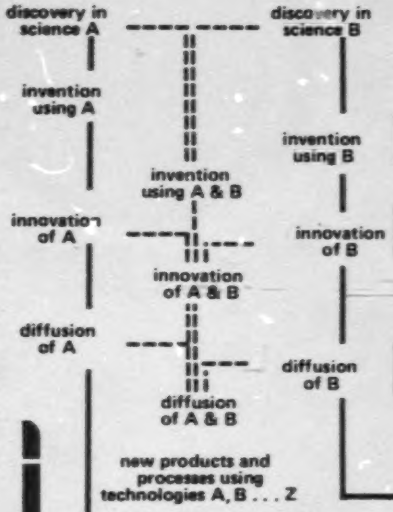
TECHNOLOGY & DEVELOPMENT

UNITAR NEWS VOL. 6 NO. 4 1974


discovery in science A
discovery in science B
invention using A
invention using B
invention using A & B
innovation of A
innovation of B
innovation of A & B
diffusion of A
diffusion of B
diffusion of A & B
new products and processes using technologies A, B . . . Z

invention using B: [the act of conception, the association of a technological possibility with a potential need ;]

innovation of B: [the introduction of a new idea to the economy ;]

diffusion of B: [the spreading of the new technology through the whole industry .]

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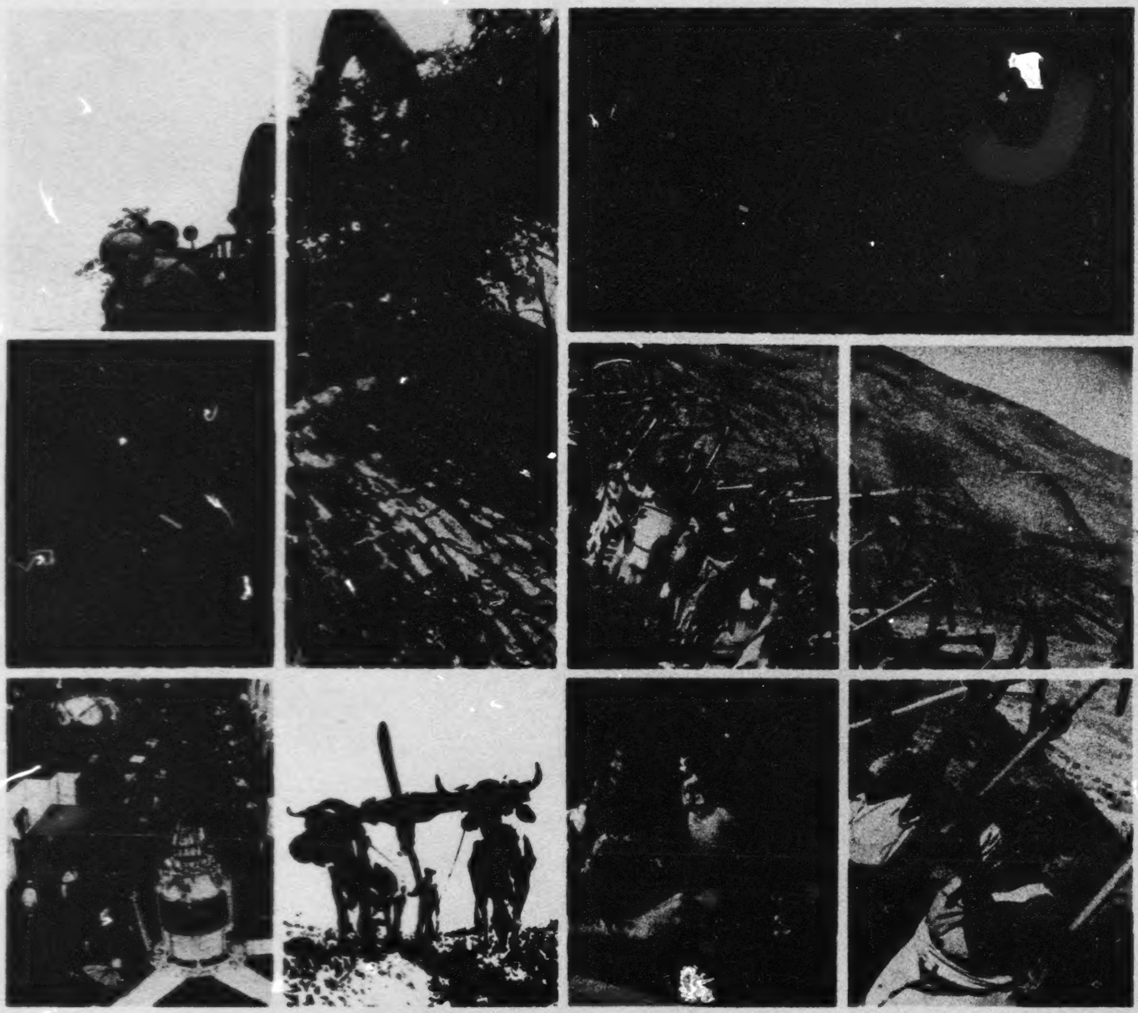

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ACKNOWLEDGEMENTS

In addition to the authors cited in the table of contents, we have drawn heavily upon the advice, expertise and patience of staff members of the following United Nations bodies : the Department of Economic and Social Affairs, including those in the Office of the Under-Secretary-General, in the Office for Science and Technology, in the Ocean Economics and Technology Office and in the Centre for Natural Resources, Energy and Transport; the UN Development Programme; the UN Conference on Trade and Development. A special word of thanks to Joseph Barnea, formerly Director of the Resources and Transport Division, now expert consultant to UNITAR.

The diagram on the cover is taken from Marvin J. Cetron and Edmund B. Mahinske, "The Value of Technological Forecasting for the Research and Development Manager," *Futures*, No. 1, 1968. COVER PHOTOGRAPHS: United Nations.

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Preface

Matters of science and technology are actively related to all aspects of modern international diplomacy, whether this is concerned with economic development, disarmament, energy resources or the availability of food. The decision as to what direction a government will take depends on its leaders in the end, but the leaders can be powerfully influenced by international considerations and by consensus at the United Nations.

Dr. Davidson Nicol, on a recent trip to Europe, visits the International Institute of Cellular and Molecular Pathology and its Director, Dr. Christian de Duve, a 1974 Nobel Prize winner in biochemistry, at the University of Louvain in Belgium. Dr. de Duve [center] and Dr. Nicol had met twenty years ago at Cambridge University whilst working on parallel lines of scientific research. The visit was arranged by Minister Scheyven of the UNITAR Board of Trustees, and Dr. Nicol was accompanied by Baron Simon-Pierre Nothomb of the UNITAR Office in Geneva.

(photo: University of Louvain)

Transfer of technology cannot be imposed on any nation, however small. It may be carried there involuntarily by the presence of transnational corporations, a reversal of the 'Brain Drain' and other factors, but the process of active implementation stems from the government, and the degree of absorption of the new technology can be considerable only if it takes into account the cultural background of the people concerned and other determining factors, such as the availability of human and material resources.

I feel that every nation should have its own national scientific advisory council and that a wise scientific advisor should always have an important role in the bureau of every leader of government. The technical issues under consideration are too involved for scientists not to be intimately connected with the process of decision-making at a very high, if not the highest, level. This problem has not yet been satisfactorily resolved in advanced countries, and it would be idle to believe that it would be easy of solution in developing countries. The latter have the advantage, however, that the ramifications of scientific and technological research are not yet so great as to defy harmonious and workable decisions between scientists and governments. The political will, however, must exist.

The United Nations and its Advisory Committees offer to developing countries a pool of expertise and a fund of experience of past achievements and mistakes which make for an excellent forum at which these matters can be discussed by both developing and developed nations. Between national policy and international agreement there seems to be an important role for regional organizations and conferences, particularly as there appear to be so many common problems between neighboring countries. Scientific research and the proper application of technology have no national frontiers and may be best solved by formal meetings and informal exchanges within a region, before these matters are taken up in a broader international setting.

Very little can be accomplished, however, unless the imbalance existing in the past can be corrected by a reappraisal and readjustment of the current economic relationship between nations. It is towards this goal, as it applies to science and technology, that we have decided to produce this special issue of UNITAR News.

This UNITAR News surveys some of the elements of technological change and its effect on development and presents in digest form the key issues involved. It is intended to stimulate questions, disseminate ideas and present a range of opinions. We hope it serves its purpose.

Davidson Nicol
Executive Director, UNITAR

The United Nations
and
Technological Change

Philippe de Seynes
Under-Secretary-General for Economic and Social Affairs

These comments were written while the Second Session of the Third United Nations Conference on the Law of the Sea was in session in Caracas. This Conference was convened because the international codes relating to the sea find themselves for the moment, if I may be permitted, quite "at sea" themselves. And the reasons for this, as Mr. Stavropoulos has said, lie in "the transformations of the world since the end of the Second World War, particularly the advance of technology and the coming into being of numerous new states."*

Technological change is of course the angel and the devil that pervades all the large new problems with which the world seems almost abruptly to be confronted. Because the impact of the new technology is seen everywhere—on the process of development, on the state of the environment, on population growth rates, on agricultural production, on the livability of cities—the several problems can, and indeed should, be viewed as one complex whole, capable of penetration at certain key entrances. This the United Nations has come to realize. And so the World Population Conference, convened in August 1974 in Bucharest, discussed its subject as it related to development, resources and the environment. The World Food Conference, convening in Rome in November 1974, inevitably is called upon to consider the degrading of elementary ecological balance, international trade and population growth rates as well as the state of and prospects for agricultural technology. The intimacy of such interconnexions has not always seemed so obvious.

The advance of technology has had its effect on everything, certainly on the law, and the proximity of the Caracas Conference makes it opportune to speak of its impact on the international law of the sea. Only a few decades ago, virtually universal agreement determined the limits of territorial seas adjacent to nations, and global concurrence defined what was meant by the open sea with its unrestricted access to the passage of ships and the overflight of aircraft. Then advances in the techniques of oil exploration led to the discovery of vast petroleum deposits in the continental shelves, those submerged portions of the land masses that in some areas extend hundreds of kilometers out to sea. Progress in drilling technique enabled this oil to be extracted through hundreds of fathoms of overlying seawater. As might have been expected, many nations demanded exclusive rights to the oil adjacent to their shores, even though it lay well beyond the old territorial limits, and suddenly the sea was much more than merely a fishery, a highway and a laboratory.

Much of this is well known, although its impact on international law has not yet fully entered the public consciousness. The situation is further complicated by the discovery of an immense treasure of ferromanganese nodules scattered even into the abyssal depths far beyond the continental edges. The most vivid expectations have been aroused that the sea floor has much more to yield. The advent of nuclear fusion, perhaps less than a generation away, could conceivably transform the waters of the sea into the principal power source of the 21st century. All this generates an atmosphere of unreality, of science fiction, in which nations are nonetheless expected to act sensibly.

Oceanic affairs provide a reasonably good illustration of the kinds of demands exerted on the United Nations Organization by the continually astonishing advance of technology. Recent and startling geological concepts have yielded a new understanding of how commercially valuable minerals were formed and deposited by tectonic activity on a continental scale. Teledetection by space satellites identifies tectonic patterns over vast regions, suggesting that future exploration may well cover larger areas than those delimited by national frontiers.

Indeed, the pervasive influence of technological change is drawing more and more concerns into the purview of the world organization. The interdependence of all nations, so graphically illustrated by photographs of the earth from space, has been intensified by a variety of factors. Global problems of food shortages, environmental pollution, scarcity of non-renewable resources, population growth rates and explosive urbanization have been induced by technological change and require technological solutions. Together they constitute a single problem with separate but interacting variables, and the overall solutions can often only be undertaken on a global scale.

The fact of interdependence, both of problems and nations, has recently and rudely been brought home to us by the oil crisis. But here too, many other factors are involved, running an immense gamut of international concerns: the continued prosperity of the industrial nations, the developmental prospects of the poor nations, the international balance of payments, and the production of fertilizer and therefore of food. Yet another outcome of the crisis is the enhanced possibilities of economic development in those previously poor countries that happen to own major reserves, and the further possibility that their new prosperity may have its impact on poverty-stricken areas beyond their borders.

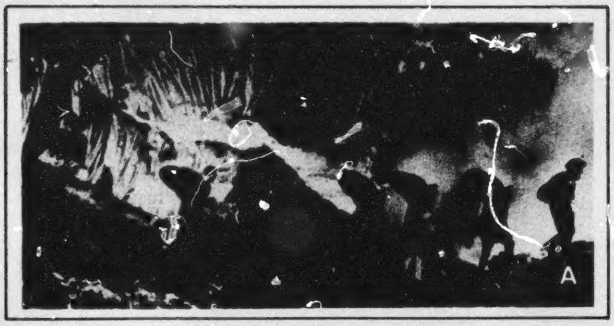
Technological advance has brought to the forefront an ancillary issue that has occupied the United Nations since the day it was founded—how to transfer technology to the Third World. Some examples, of course, already exist. Preventive medicine has slashed mortality rates in the poor countries, an achievement deserving of unstinted praise even if it has also given rise to rapid population growth. The next step, so it was assumed, would be to export the trappings of industrial technology, following the lead of the developed nations along a demonstrated route towards prosperity and lower birth rates. In this model of development, a principal role was assigned to those multinational corporations based in the industrialized world and seeking markets and labour outside it.

Today, the international community has come to realize that the interests of transnational enterprises do not always coincide with the economic goals of developing nations and is aware that there are limitations to the effectiveness of international business as an agent of technological transfer. This, coupled with the immense problems created by industry itself, has given rise to questions that perhaps should have been asked long before. Are present patterns of industrialization, developed to fit European and North American circumstances, really appropriate for other cultures? Does bringing technology to the developing world inevitably mean the introduction of rampant consumerism and environmental pollution? How can technology be applied in the Third World so as to improve the quality of life for everyone, and not merely to enrich a select elite?

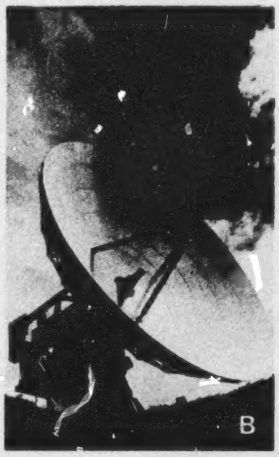
The less-than-optimum performance of "automatic" mechanisms would seem to reinforce the need for long-range planning and to increase the responsibility of planning agencies, especially those of the United Nations. Doubts about the transfer of existing models of industrialization have lessened confidence in the traditional planning process. The current situation cries out for imagination and innovation. But innovation entails risk, and it is an open question whether the United Nations is constituted to take the risks that circumstances seem to require. Yet what other organization has the facilities and global perspective? Despite all the criticism voiced against it, we must not forget that it still bears the hope and expectations of the majority of the world's peoples.

Given the internationalization of so many phenomena, it is not smugness to reassert the vocation of the United Nations system. The times require an international market place open to the discussion and resolution of issues that transcend national boundaries. Technological change, combined with the emergence of so many new nations, has confronted the world organization with a set of problems beyond anything envisaged by its founders in San Francisco.

More effective institutional arrangements must be conceived with a certain imagination. They must be politically feasible and demonstrate their practicality in the cauldron of experience. Although we may have moved beyond some of the old procedures and attitudes, technology assessment, the determination of which industrial patterns would be best suited to a given set of circumstances and a particular national outlook, is at present an underdeveloped science. Perhaps a United Nations unit devoted to such assessment could advance the science, while encouraging the formulation of coherent national scientific policies. Such a unit might help us gain control over the dynamism of technology, which so often seems endowed with a will of its own acting without regard for human values and desires.



Out of the unequal contest between rich and poor, new attitudes of self-reliance have begun to appear in the Third World, often taking the form of associations among nations, strengthening the hands of those with few cards to play in the game of international commerce and industry. All countries should support this evolution toward a correction of long-established imbalances, both for what it will yield on its own terms and for what it will do for the self-respect of peoples who have sometimes been lacking in self-confidence, a prerequisite for successful development. The trend might be stimulated if the appropriate United Nations bodies were endowed with modest resources to smooth the way and advise on the technical problems involved. In the transfer of technology, as in other important matters, the Third World can only benefit in bargaining from a position of greater strength.



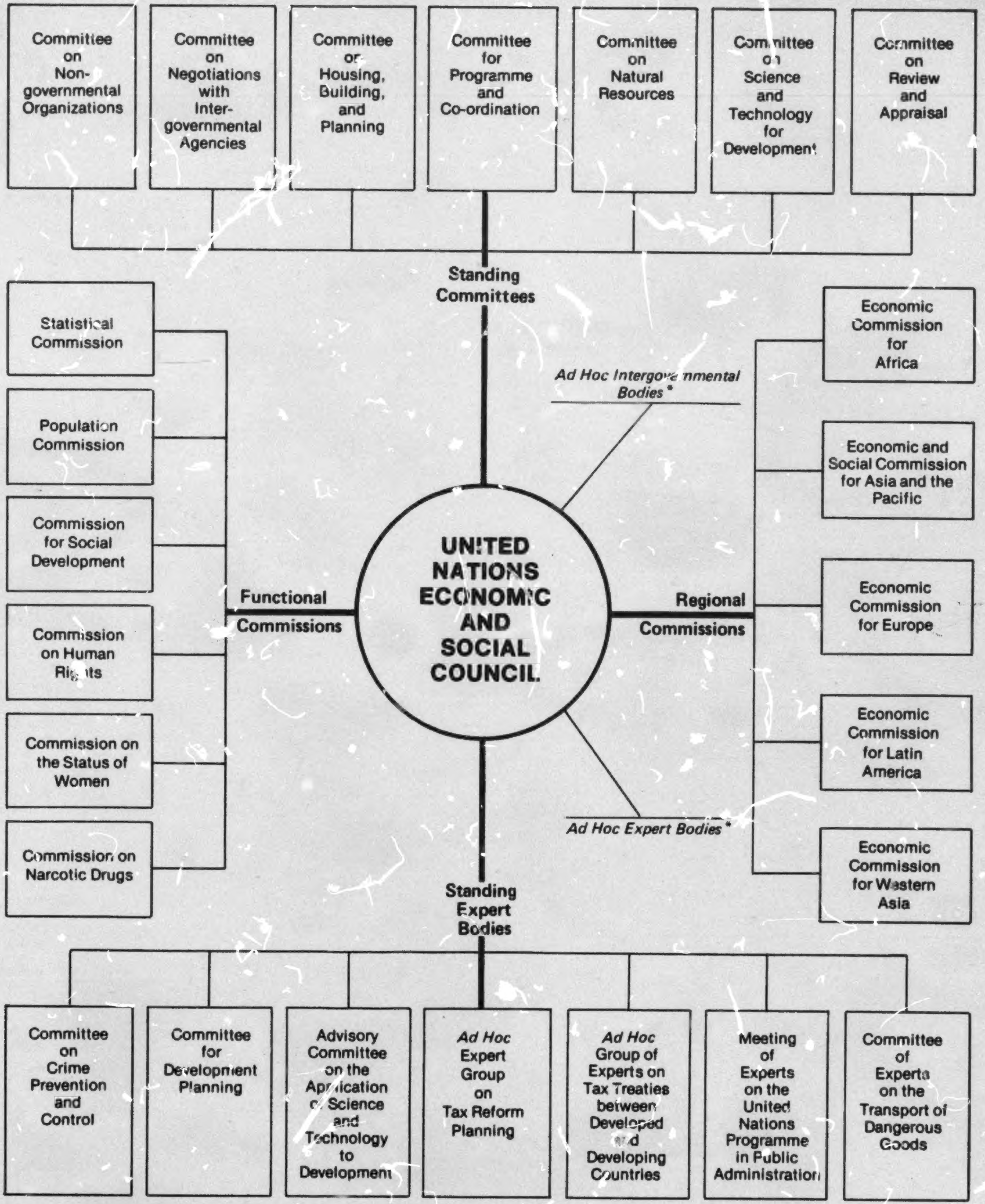
We have passed beyond that phase of developmental assistance characterized by expert missions, training fellowships and the organization of seminars, though such activities were very useful in their day. Responsibilities toward the Third World might be better fulfilled if the world organization were to turn toward a concept of making services available to governments on request. At this stage, we need not limit ourselves too rigidly as to what such services might involve. They could include research and analysis, the dissemination of information, development projects, experiment and innovation, and the services of intermediaries to rally co-operative efforts, bringing to the task a comprehensive catalogue of resources and techniques.

If such proposals were initiated, they would introduce modifications in the institutional framework of the United Nations as it is now organized. Yet such modifications should readily be accepted if they contribute to an *élan* which reveals itself in a spirit of innovation and daring that may be essential to the fulfillment of the United Nations mission among the nations of the Third World. The world is in a ferment of creative imagination, as the advance of technology continually reveals, and ways must be found of inducing this imagination to permeate even organizations dedicated to compromise and conciliation. It must be made to work through bureaucratic structures that sometimes seem hostile to the individualism and idiosyncrasy from which invention springs.

This is not to say that an inventive spirit is antithetical to the arts of compromise. Nor is it to say that the only technological challenge that confronts the United Nations is that which relates to the central problems of the Third World. The Caracas Conference can serve to remind us that many of the issues associated with technological change affect rich and poor nations alike, whilst others are almost the exclusive concern of nations already industrialized. As such issues move increasingly beyond the confines of national borders and become ever more subject to international negotiation, the United Nations will continue to serve as the world's pre-eminent international forum.

*Constantin Stavropoulos: "Procedural Problems of the Third Conference on the Law of the Sea," UNITAR News, Vol. 6, No. 1, p. 16.

PHOTO A: UN geologist on natural resources survey of Nepal B: Satellite Communications Centre near Ahmedabad, India C: FAO irrigation expert in Iran


Committee on Non-governmental Organizations
Committee on Negotiations with Inter-governmental Agencies
Committee on Housing, Building, and Planning
Committee for Programme and Co-ordination
Committee on Natural Resources
Committee on Science and Technology for Development
Committee on Review and Appraisal
Standing Committees
Statistical Commission
Population Commission
Commission for Social Development
Commission on Human Rights
Commission on the Status of Women
Commission on Narcotic Drugs
Functional Commissions
Ad Hoc Intergovernmental Bodies*
UNITED NATIONS ECONOMIC AND SOCIAL COUNCIL
Regional Commissions
Ad Hoc Expert Bodies*
Economic Commission for Africa
Economic and Social Commission for Asia and the Pacific
Economic Commission for Europe
Economic Commission for Latin America
Economic Commission for Western Asia
Standing Expert Bodies
Committee on Crime Prevention and Control
Committee for Development Planning
Advisory Committee on the Application of Science and Technology to Development
Ad Hoc Expert Group on Tax Reform Planning
Ad Hoc Group of Experts on Tax Treaties between Developed and Developing Countries
Meeting of Experts on the United Nations Programme in Public Administration
Committee of Experts on the Transport of Dangerous Goods

**Set up as required for special projects*

Taken from E/5453, 20 February 1974, p. 5.

Problems and Priorities

João Frank Da Costa, Chairman of the Committee; Minister Plenipotentiary, Department of External Relations, Brazil.

Guy Gresford, Vice-Chairman; Senior Adviser on Science and Technology and the Environment to the Department of Foreign Affairs, Australia.

Trevor Boothe, First Secretary of the Permanent Mission of Jamaica to the UN.

Bertrand Chatel, Chief of the Science Applications Section, Office for Science and Technology.

This informal discussion was recorded especially for UNITAR News after the second session of the Committee on Science and Technology for Development (CSTD), which met from 11 to 29 March 1974.

Da Costa *I think at this session we had a rather constructive and practical approach, and maybe one of the most important decisions taken was to draw up a list of specific problems facing developing countries. It is an important thing to have this list, without any kind of priorities, because we do not know what are the specific problems of many developing countries. So this list is needed for further action by the Committee. And I think this may be one of the most important practical things we have done here.*

Gresford *Of course, it is going to be very difficult to get one list which is going to suit everybody. We talk about developing countries as if they are all the same, but in fact the problems of countries and the priorities they will want to apply are very different. This is why the whole question of studies on technology assessment and appropriate technology should be stimulated within the UN system.*

Boothe *It is my opinion that studies of technology assessment, appropriate technology and technology transfer must be three of the principal areas of concern for the Committee in its future work. I hope that when the intersessional group meets next year to begin considerations of the work for the forthcoming Second World Conference on Science and Technology that these three areas will have priority consideration.*

I conceive of technology assessment as a form of policy research, designed to provide some balanced appraisal to the policy maker. As such, it should seek to identify policy issues, to assess the impact of alternative courses of action and to present its findings in a comprehensive manner, which will provide the policy-maker with alternative courses of action.

Chatel *One important step which has been taken by the Comittee during the present session has been to select the problems of "Arid Areas" for concrete action in the coming years. A task force from the UN and its specialized agencies is being set up with an intergovernmental working group to identify the kind of worldwide co-operative action in science and technology which can be envisaged to solve the problems of the arid zones.*

Da Costa *Selecting a technology involves assessing what the economists call social costs, that is to say, the real costs of a technology, and that cannot be done on a world or even on a regional basis. Each country has its own problems. I think the idea of choosing a special area of action—arid zones, for instance—is a very important approach if we are going to implement the World Plan. We are now trying to do it on a regional basis and personally I do not think this is appropriate. A good approach is the topic approach. Problems within a region may vary widely but if a country on the American continent can make contact with a country in Africa having similar problems, they can learn from each other.*

Boothe *I have a slightly different approach on this. I agree up to a point with Mr. Da Costa, in that I do believe that there must be the initiatives and approaches worked out on a national basis, but at the same time I think we must combine that with the international approach. I am looking here especially to future methods. We really must address ourselves to ways and means of avoiding another situation such as that which has come about in the Sudan and Sahelian region. I have in mind, for instance, the use of remote sensing. The technology is in a sufficient state of development, and the material is there to undertake global monitoring and sensing. Indeed the UN Environment Programme has something along these lines very much in mind, and I think it would be wise for the Committee to take into consideration the work being done in this field and to see how we can co-operate to avoid disasters of this kind*

Gresford *I am glad Mr. Boothe raised this question of remote sensing, because it ties in so well with what we were saying earlier about technology assessment and appropriate technologies. There is a feeling in advanced western countries that technology assessment is a very highly sophisticated and complicated mathematical approach to forecasting with model building, simulations and the use of computers and so on. Indeed it has been very successful in that line, but I think that in our work with developing countries we want to bring it down much more to specific problems and specific needs. The arid zone problems are very much in our minds at present, and technology assessment there would seem to me to involve a realistic appraisal of the feasibility, the costs, the benefits—economic, social and political—of the whole gamut of technologies which might benefit these areas. These range from such highly sophisticated technologies as remote sensing,*

A: Subsistence farming in arid area of Baluchistan

satellite photography and so on, right down to simple technologies of water desalination, solar distillation by simple cells and similar innovations at the village level.

Chatel *I think a very important decision taken by the Committee at this session is the proposal for a feasibility study, to be undertaken by the Secretary-General, on the establishment of an international information exchange system on technology transfer and assessment. UNESCO has already undertaken a worldwide co-ordination of information systems in science and technology, but this is so comprehensive that some persons have expressed concern about how it could be used practically by the developing countries. The new proposal is to establish a system of exchanging information about computer-based technology and particularly on technology transfer and assessment. It is hoped that funding organizations such as UNDP, IBRD and the regional development banks will contribute to support this project so that the developing countries themselves can establish and strengthen on a national basis systems for providing information related to science and technology.*

Boothe *I agree entirely with Mr. Chatel on this. If followed through, this can provide developing countries with a framework within which technology transfer can be completely reassessed, and for them this is of the utmost importance, because technology transfer as it is presently conducted is not necessarily always in their best interests.*

Da Costa *I think something could be done in a small way over the coming months to inform developing countries about existing technologies and the social costs of such technology, because nobody knows better than the country itself whether a technology is appropriate or not. There are also political reasons. If the decision is made, for example, by a developed country, "This technology is good for you but not this one", it may just be an attempt by that country to pass along obsolete and second-class technology that is not wanted. It is also important to strike a balance between imported and local technology, and this is a decision that has to be made on specific grounds. You cannot say, "I am going to import fifty per cent and the rest I do at home" in every case. The country has to decide each situation on its own merits. It might decide in one case to import technology one hundred per cent, because it can do nothing in that sector for the moment, but in another sector it might import seventy-five per cent and do the rest itself. Because when you want to have your own technology but do not have the basis for it, yet prevent technology transfer, you are hindering your development, and that is a thing that has to be avoided at all costs.*

Gresford *I agree wholeheartedly with what Mr. Da Costa says about the need for these decisions to be taken by the developing countries concerned, but the corollary to this of course is that there must be trained people available to implement these decisions, and this, I think opens up a whole new area of discussion to which the Advisory Committee on Science and Technology has given some attention in the past, namely, the need to build up a science infrastructure. This is not a matter which we discussed specifically at this session of the CSTD, but I believe it is something which must be continually in the back of our minds, because all these decisions and all these resolutions will not lead to any action unless there is a build-up in the developing countries themselves of the capabilities which are needed to assess technology and to make the sort of decisions that Mr. Da Costa has been mentioning.*

Boothe *I could not agree more with the two statements just made. Any technology transfer must be accompanied by the creation of the technology infrastructure within the developing countries themselves. The two must go hand in hand. I think, however, that the international organizations have, in the early stages at any rate, quite an important role to* *play here, particularly in three aspects. First, there is the question of the cost of technological dependence, which can be broken down into direct costs, indirect costs and other costs. A certain amount of research has already been done on this by UNIDO, I think. However, the surface has barely been scratched in this very important area. There is need for tremendous work to be done and the time is now, not five years from now. This is the time it is needed.*

The second area to which I would direct attention is the need for analysis of technology transfer projects before implementation. Here again, I think that in the initial stages international organizations have a role to play, but this must in turn be taken up by the scientific and technological personnel and establishments within the developing countries themselves in the later stages.

The third area is that of cost benefit analysis in the choice of transfer projects. These three areas together constitute in my opinion a major focus for work to be undertaken in the near future.

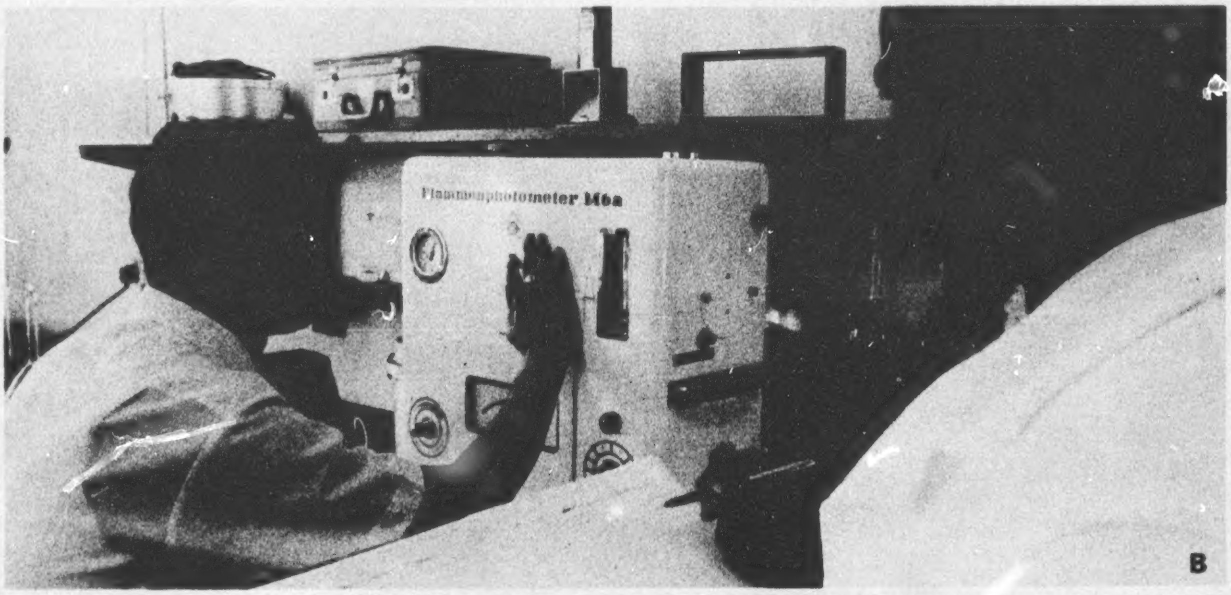
Chatel *There are some immediate steps suggested by the Committee. The World Plan of Action is a set of global guidelines for the application of science and technology to development. During the last two years regional plans for science and technology have been prepared in developing countries, and now the Committee is encouraging proposals for national planning of science and technology. A resolution put forward by the Philippines had a wide consensus. It proposed that such planning could be stimulated by small meetings or seminars in the various developing countries, involving regional economic commissions and other UN bodies and offices for science and technology together with national decision-makers—economic and political—as well as the scientific and technological communities. These meetings would encourage co-operation in policy-making by giving expression to innovative thinking, revealing new options available in planning and also in the preparation of specific projects in science and technology which would then be submitted to the UNDP, the World Bank, or the regional development bank for further implementation.*

Da Costa *I would say the main task of this Committee at its next session would be to encourage the creation in developing countries of an indispensable infrastructure—an organ responsible for controlling technology transfer. Development has to be linked closely with the institutions already recommended for the planning of science and technology. It is the only way to have a technical basis for development.*

Gresford *I would put it in a slightly different way. I think the basic problem is to ensure the integration of science and technology with national policy planning, and this, incidentally, is not a problem which has yet been solved in the developed countries. It is not a problem peculiar to the developing countries.*

Boothe *I think that in approaching this question of technology assessment and in defining the appropriate technology and then the transfer of that technology, what is really needed is new thinking, based not necessarily on age-old concepts but on new societal approaches. New thinking, new programmes with entirely different parameters, new and innovative methods of implementation.*

Chatel *I think that this meeting of the Committee has shown a great interest from developing countries in the potentialities for co-operation with other developing countries. Some developed countries have important bilateral programmes and therefore sometimes consider the international channel as a competitor to these national or bilateral programmes. But this Committee, due to the excellent atmosphere which was quite apparent during the sessions, revealed an interest from both developed and developing countries in new channels for international co-operation in science and technology for development.*



B: Analyzing soil samples in Tanzania

Appropriate Technology

Derek Lovejoy
UN Development Programme (UNDP)

What is Appropriate Technology?

The term "appropriate technology" is gaining currency in development literature. Its use carries the clear implication that there are particular choices of technology which are more appropriate to developing countries than to developed countries. We hear also of "alternative technology," the "technology shelf" and—especially in connection with rural industry and farming—of "intermediate technology."

Every time an industry is introduced to a developing country for the first time, or a new factory is built, somebody has probably made a choice of technology (or a series of choices) whether it be of a particular industrial process, a product design, raw material inputs, a degree of mechanization, or a management system. These choices are made by engineers and economists, in most cases as part of the normal investment decision, for large factories where major investments are involved.

Even if the engineer or economist is himself from the developing country, he has probably been trained abroad, or by professors who have been trained abroad. Consciously or unconsciously, his choice may be influenced by factors that may be appropriate to an industrially advanced country but less so to a developing country. But is this necessarily so? The suspicion is there but appearances may be deceptive.

Perhaps the appropriate technology for planting rice in a particular deveveloping country would be a better made hand tool and not a mechanized planter, but that hand tool may not have been invented yet or may not be accessible to the local farmer. Who will advise him?

Three dimensions can usually be identified in discussions of appropriate technology: employment promotion and labour intensive technologies; proprietary technologies involving patents, licenses, trademarks and special "know-how"; and adaptation of technologies to local market sizes, consumer taste, available raw materials and intermediate components, and worker and management skills.

Labour Intensive Technologies— Employment or Growth?

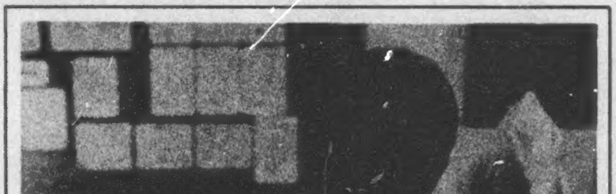
The first choice appears to be—more men or more machines?

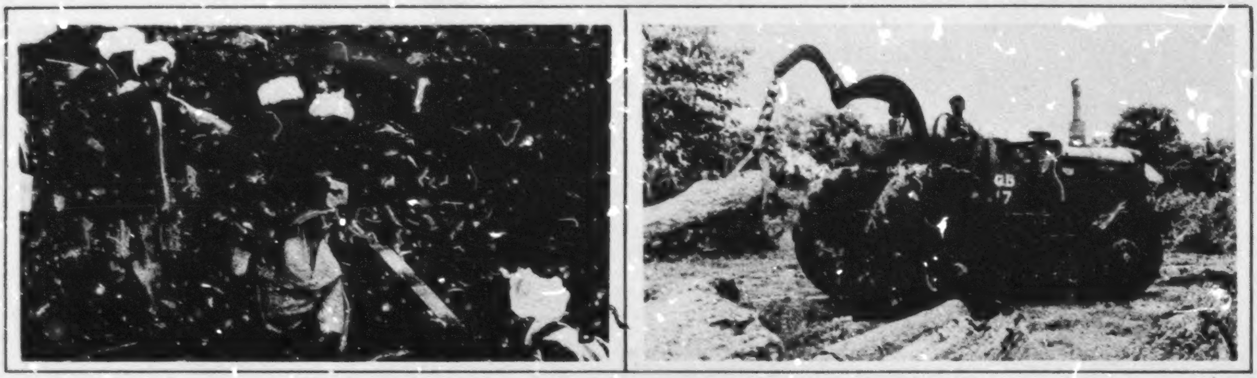
We can all think of examples, especially in building roads, dams, irrigation canals and construction works of all kinds where there is a choice between using bulldozers and earthmoving machinery on the one hand, or picks and shovels and wheel barrows on the other. Within a manufacturing industry, materials-handling offers similar choices of capital or labour intensive operations. This is also the case in agriculture and rural industry.

There is no doubt that in many developing countries where urban and rural unemployment is a major and increasing problem, the possibility of choosing a labour intensive technology is highly attractive on social and political grounds. Unfortunately, the choice may have economic implications at variance with other, equally valid, social and economic goals.

Specifically, it appears that, in the mixed economies prevailing in most developing countries, a labour intensive approach may be effective in promoting employment but will do so at the expense of economic growth rate as measured by GNP.

This conclusion is based on the well known fact that the marginal propensity of a worker to save is much less than that of the owner of the capital goods. The use of labour-intensive technology in a sector of the economy based on wage labour would thus generate less savings and less investment for future growth than use of capital intensive technology. It is also clear that the conflict between employment and growth only arises in cases of economic activities based on wage labour. Thus,





employment of capital intensive technology in the modern industrial sector is not inconsistent with the use of labour intensive technology on farms owned and worked by underemployed peasant proprietors. Each country must determine, in the light of its own social, economic and political needs and goals, where it makes the trade-off between reducing unemployment on the one hand and increasing economic growth on the other.

Proprietary Technologies—Imported Know-How or Technological Self-Reliance?

The second dimension to the discussion on appropriate technology concerns the problem of proprietary technology. When a new technology is introduced it may come from the field of technologies on the open market, but in many cases a desired technology is covered in part or in whole by patents or by trademark protection, or it may simply be that certain critical steps are a closely guarded trade secret.

In this case the developing country manufacturer must enter into some sort of agreement with the owner of the know-how. Usually this takes the form of a licensing agreement to use the process covered by the patent or trademark and includes provision for technical or management assistance in that agreement. In some cases, the company owning the process may enter into partnership with the local manufacturer, or set up a wholly owned subsidiary.

The trouble with this mode of acquiring modern technology is that it is an imperfect market for the buyer, who is usually not in a position to have full information on the relative merits of possible alternatives. Moreover, licensing agreements may have restrictive clauses tying purchases of raw materials and intermediates, fixing their prices in favour of the licensor, or restricting export sales. Moreover, the buyer may in fact pay for an entire process when all that he needs is technical assistance with one particular part of it. He would like an "unbundling" of the package so that he pays only for what he needs and for what is proprietary knowledge.

But how then to acquire the appropriate technologies needed by developing countries? Would some sort of consumers' guide to modern technology help? Many developing countries are enacting legislation to protect the interests of their nationals in negotiations with foreign investors and licensors.

The alternative to importing the technological know-how is to attempt to "go it alone." Certainly, no country can develop without importing *some* technology from abroad. But it is also clear that the effort to evolve its own technology, using local skills and competence to the fullest extent, engenders a "technological self-reliance' and self-confidence that is in itself essential to development. Where to strike the balance?

Adaptation of Technologies—Adapt or Develop?

The third dimension of the appropriate technology discussion is the problem of adaptation. When a new factory is finally set up corresponding to a chosen technology there are still many problems to be solved before the factory can produce effectively in the special local conditions. These latter may include:

(a) Adaptation to local raw materials and intermediate components. A particular plastic or alloy steel may not be available and a substitute must be found. Locally available components may not meet quality standards. Can they be improved? A transistor radio may need to be redesigned to suit a limited range of locally available transistors and radio components. A metallurgical process has to be adapted to the type of local ores available.

(b) Adaptation to local labour and management skills and practices. It may be necessary to replace the mechanized handling of materials by hand labour, to introduce simplified maintenance procedures, or to organize production on an hourly rate instead of on a piecework basis.

(c) Adaptation to local market conditions and tastes. This may be a matter of special product design, of packaging, or of corrosion and fungus inhibitors to take account of adverse climatic conditions. It may also include adaptation to small scales of production, or to simplified and inexpensive products

In the end the process of adapting an imported technology to local raw materials, labour, management, market preferences, and scales of production may lead to a development of a completely new product. One can cite as an example the "jeepneys" (bus bodies on the chassis and engines of small vehicles, originally war surplus jeeps) produced in the Philippines.

How is such adaptation to be encouraged? By industrial research institutes? Technical universities? Engineering design centres? Or is there some other way of encouraging the local inventor?

How Useful is the Concept of Appropriate Technology?

It seems then that when we analyze the concept of appropriate technology we are led into a discussion of three different sorts of activity and into questions of technology choice which are not necessarily peculiar to developing countries, although there may be some common characteristics to the problem of choice of special concern to them. If the use of the term serves to draw attention to some of these special problems, it serves a helpful purpose. If, however, it is allowed falsely to suggest that there exists a shelf full of technologies ready and waiting to be dusted off and used to solve all the current problems of development, then it can only obscure and confuse the real situation.

PHOTO A: Trainee at Pilot Centre for Leatherwork, Algeria B: Bridge-building in a rural self-help development programme in Afghanistan C: Forest industries development, Sri Lanka

Pros and Cons
of
Intermediate Technology

Ademola Banjo
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The origins of the appropriate technology movement are to be found in the earlier but smaller intermediate technology movement. The most successful initiative in this latter appears to have originated in the United Kingdom. The intermediate technology creed was quite simple. It postulated that in the developing countries societies and technological cultures were at an earlier stage of historical development comparable with pre-industrial Europe or the early industrial period in Europe. As such, many of the activities for which technology was needed could be adequately satisfied by technologies similar or analogous to those which had been used during those early periods of technological development in the present-day developed countries.

Hence, the prescription of the intermediate technology school was that most of the technological requirements of the developing societies could be met by importing primarily the older, simpler machines and processes which had been superseded by more sophisticated ones.

Eventually this attempt to prescribe the use of obsolete technology and equipment as a solution to the technological development problems of (initially) primarily African countries engineered a countercurrent of opposition from many quarters—from Africans themselves, particularly the technological community, who were brought up on and had become familiar with modern technology. This group believed that obsolete technology was not the solution. They argued that if the objective was to close the technological gap, then the proper cause to support was the use of the most effective technology available.

Another group of opposition to the intermediate technology creed consisted mainly of development theoreticians and planners. They argued that intermediate technology gave low productivity and often turned out to have higher production costs and could not compete with similar products made with modern technology.

For the sake of comparison, it is useful to extract and compare the claims and arguments of the intermediate technology movement and their opponents.

According to the supporters of the creed, intermediate technology offered the following advantages:

a) It was simpler and easier for people with a low level of technological culture to understand and practise.
b) The equipment was cheaper and offered a lower scale of production (an advantage for small markets).
c) Obsolete or secondhand equipment embodying simpler technology was already available.
d) Intermediate technology was more labour-intensive than modern technology; hence its introduction would promote employment.

e) Intermediate technology was not as socially disruptive as modern technology. Hence social dislocation could be avoided or minimized.

The opposite side had arguments that ran as follows:

a) If people had to learn new technologies, they might just as well learn the most modern and effective ones, as the intellectual effort was essentially the same.

b) The cost of a particular plant installation with older technology might be lower, but because of the lower productivity the actual capital cost per unit produced was often higher. Hence the final cost per unit of product often turned out higher.

c) With obsolete or secondhand equipment maintenance costs were higher and operation often needed a higher level of individual skill in the labour force than for modern plants. Furthermore, spare parts could become unobtainable and would have to be specially made at greater cost.

d) Only by raising productivity can employment be increased. This would bring costs and prices down and hence promote consumption and the ability to export in competition with similar products.

e) Development implied social change and there would be dislocation anyway. These should be taken care of by appropriate social policies and programmes. In any case, many communities were prepared to pay the price of social disruption, if necessary, to raise their standards of living as rapidly as possible closer to those they already perceived possible through the modern communications media.

The appropriate technology creed is the compromise position between these two groups. The premises of the appropriate technology movement are something like the following:

a) Either intermediate or modern technology might be the best solution in a developing country situation, but the actual choice should be made on the basis of production, manpower availability, market size, and other social and economic considerations.

b) In many cases the appropriate technology, even if a simple technology, will be a new technology derived by research and development. So, simple technology does not always imply obsolete imported technology.

c) Appropriate technology should not add to the problems of unemployment but should promote employment wherever possible.

With this compromise one would think that the schism in the thinking on technological development in the African countries had been resolved. Unfortunately, the compromise was only in terminology. The partisans have still largely retained their view points under the umbrella of appropriate technology.

Most supporters of the earlier group, which includes primarily aid-giving agencies and organizations in the developed countries and a number of African leaders who are outside the field of technology, continue to speak of appropriate technology but really mean, of necessity, simple intermediate technology. To answer the arguments of the opposite camp, they have focused their attention on rural development where many of the premises of the opposition do not hold.

The modern technology protagonists also accept the term appropriate technology, but continue to hold their views about using the most effective technology available. This group has its attention focused on industrialization, in which domain their own premises are valid.

In reality, the two groups are oriented to different objectives. Hence their interpretations of appropriate technology cannot be reconciled. Perhaps each group has a bit of the truth in its own domain. However, it is important for us here to take note of the context of objectives when we approach this subject.

Extract from: The Report on the International Workshop: *Development and Dissemination of Appropriate Technologies in Rural Areas*, Kumasi, Ghana, July 1972, German Foundation for Developing Countries, Berlin.

***PHOTO A:** Training project in animal husbandry for arid zones, Tunisia **B:** Laboratory technician in project to develop small enterprises, Singapore **C:** Trainee in timber utilization, Central African Republic **D:** Soil and water management research, Rajasthan Canal area, India*

The Work of The Intermediate Technology Development Group

E.F. Schumacher
Chairman of the Group

The Intermediate Technology Development Group was set up in London in 1965 to investigate ways and means of utilizing to the fullest extent the resources available to developing countries through the application of appropriate technologies. It is funded mainly by grants and donations from charitable foundations and works closely with the governments of developing countries—making feasibility studies, supervising projects when agreed and evaluating their impact on development. Extensive overseas experience had led to a number of conclusions or, as its founders thought, a number of *insights* that seemed to cry out for practical application. They may be summed up as follows:

> *First:* that the source and centre of world poverty lies primarily in the rural areas of poor countries which are largely by-passed by aid and development as currently practiced;
>
> *Second:* that the rural areas will continue to be by-passed and unemployment will continue to grow unless self-help technologies are made available to the poor countries with assistance in their use; and
>
> *Third:* that the donor countries and agencies do not at present possess the necessary organized knowledge of how to adapt appropriate technologies and communications to be able to assist effectively in rural development on the scale required.

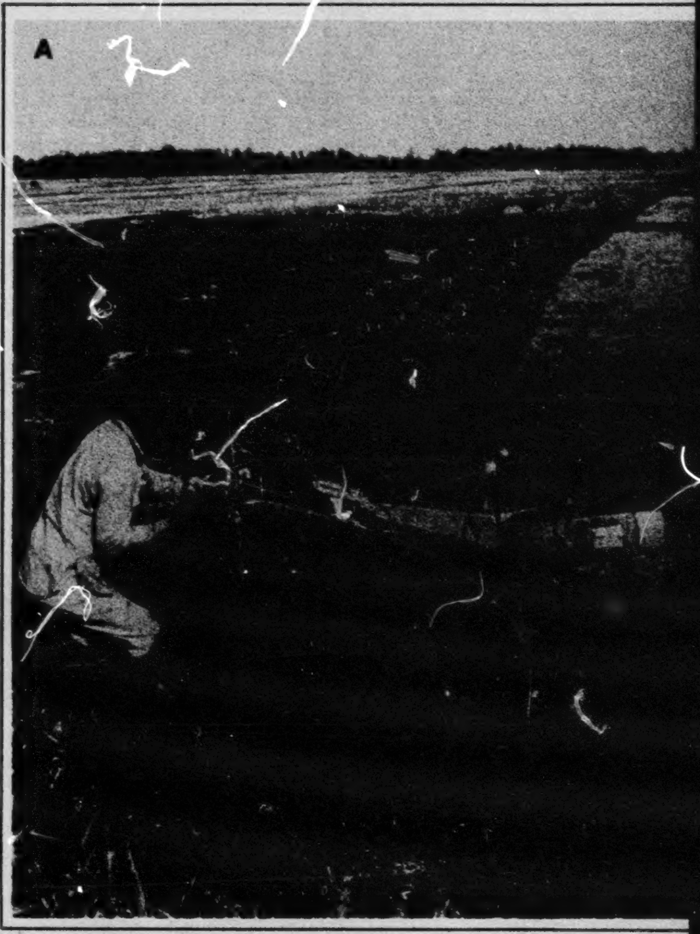
It was felt that unless the disease of poverty was tackled at its source, i.e., in the rural areas, outside the big cities, it would continue to manifest itself in three ways—mass migration into cities, mass unemployment, and the persistent threat (or actuality) of mass starvation.

It is now widely recognized that one of the most urgent needs of the developing countries is employment (including self-employment), that is, productive activity measured in millions of new jobs every year. It is also increasingly recognized that for jobs to be created on anything like the required scale, the technologies and methods of production must be appropriate to the conditions of the poor people in poor countries; that, is, they must be cheap enough and simple enough to be used and maintained by rural and small-town populations without sophisticated technical and organizational skills and with very low income.

The words "intermediate technology" hint at two things:

> *First:* that in matters of development there is a problem of technology, of choosing the right "level of technology," in other words, that there is a *choice* of technology; that it cannot be assumed that what is best in conditions of affluence is necessarily best in conditions of poverty; and
>
> *Second:* that the technologies most likely to be appropriate for development in conditions of great poverty would be in some sense "intermediate" between (to speak symbolically) the hoe and the tractor, or the sickle and the combine harvester.

Know-how at this "intermediate" level—and also the relevant equipment—obviously existed in many places, but no one could say what *gaps* there were, and there was no point anywhere in the world where this know-how could be obtained as and when the people most in need of it required it.



Intermediate Technology *Development* therefore means the work of bringing this kind of knowledge to light, to systematize and, where necessary, complete it, and to organize a world-wide system of "knowledge centres" where it can be readily found.

Seven years of work in this field have supplied the Group with plentiful evidence that the "knowledge gap" which it set out to fill is indeed very wide. The labour-saving, capital-intensive, highly sophisticated technologies suitable for large-scale production in "rich" markets and commonly used in the rich countries are extremely well documented and easily accessible; but technologies applicable on a small scale by (or in) communities with plenty of labour and little capital, lacking technical and organizational sophistication, are, on the whole, poorly documented, difficult to get hold of, and in many cases even non-existent. There are numerous cases where the relevant knowledge and equipment used to exist but have virtually disappeared—in accordance with the well-known tendency of the "better" to be the enemy of the "good." This tendency is, of course, progressive and therefore to be welcomed, unless it deprives large numbers of people who cannot afford the "better" of the "good" they could afford.

It will be apparent from what has been said that the Group, in insisting on *technological choice*, makes a sharp distinction between science on the one hand and technology on the other, or, to put it differently, between knowledge and its application. The knowledge of scientific principles, of "laws of nature," of materials and of methods is, in a sense, absolute, and to talk of "intermediate knowledge" or "intermediate science" would obviously be silly, implying a wilful rejection or disregard of human achievement. As far as knowledge and scientific achievement are concerned, the best is the best, irrespective of economic conditions. The *application* of the best knowledge, however, can take many different forms and can lead to many different types of technology and modes of operation. It is here that the need for and the possibility of intelligent choice enters: different economic conditions demand different applications. It cannot be doubted that the technological pacesetters today are the rich countries; probably something like ninety per cent of all research and development work (R & D) is done by them, in response to their needs and interests as they see them.

The knowledge gap which the Intermediate Technology Development Group attempts to fill does not, in the Group's experience, exist primarily at the level of science; it exists mainly at the level of appropriate technology, i.e., the application of knowledge, and technological availability. Many instances can be given where the road to the cheap and simple solution demands the deployment of the most sophisticated thought processes and calculations and can be successfully travelled only with the help of the latest and best research equipment.

To give more concreteness to the work programme indicated by the words "intermediate technology," we may emphasize four criteria: a) smallness; b) simplicity; c) capital cheapness; and d) non-violence. (Other people may prefer to choose a different set of criteria.) It is by no means certain that all four criteria can be satisfied in every case; but any of them, or combination of them, is of value for our purpose.

The established trend of technological development is towards ever larger scale, towards giantism. This is considered to be justified by the "economies of scale." But large-scale production units can be economical only when certain conditions are satisfied—a high market "density," for instance, or a highly efficient low-cost transport system. When these conditions (and others, such as skill in large-scale organization, management, buying and selling) are not satisfied, the so-called economies of scale become illusory. In fact, large-scale then tends to act as a principle of exclusion. Only people already rich and powerful can embark on new productive enterprises; the small man is excluded, reduced to the position of a job seeker—and when there are not enough jobs provided by the rich and powerful, he has no possibility of becoming productive. Smallness is a *conditio sine qua non* for rural development, but it is also highly relevant from many other points of view—ecological, resource-wise and social.

PHOTO A: Power tiller installed on hand tractor, Philippines

Much the same applies to simplicity and capital cheapness. It does not take great scientific or technological creativity to take a further step in the direction of complexity and capital-intensity. It means nothing more than following the established trend. But when the demand is made to search for smallness, simplicity, and capital-saving, the normal first answer is that "it cannot be done". Experience shows that—not everywhere, but over wide ranges of application—this answer is simply wrong. It *can* be done, but it requires a more original R & D effort than is normally forthcoming.

Non-violence in this context refers to modes of production which respect ecological principles and strive to work with nature instead of attempting to force a way through natural systems in the conviction that unintended damage and unforeseen side-effects can always be undone by the further application of violence. All too often, one problem is "solved" by creating several new ones. Poor societies, which are not richly supplied with scientific and technological resources, cannot afford this kind of violence, and it may indeed be doubted whether the rich societies can afford it much longer.

The UN Secretary-General's Note (E/C.8/4) of 16th January 1973 on *Appropriate Technology* closes with this sub-paragraph:

> *"While the general subject of appropriate technologies to meet resource endowments of developing countries is almost becoming a cliché, work remains to be done at the micro-economic and technical level, both on a product-by-product basis and on an industry-by-industry basis. National research institutions in advanced countries could be persuaded to undertake projects for specific products or process research, including a systematic review of the possible alternatives."*

This precisely is what the Intermediate Technology Development Group has been doing for the last several years in collaboration not merely with national research institutions but also with numerous business firms, universities, and technical colleges both in the U.K. and overseas. Its work, however, is not confined to industry; it also extends to agriculture, building, and a variety of "software" subjects, such as rural health, training and accountancy.

The four criteria mentioned above—smallness, simplicity, capital cheapness, and non-violence—constitute a new challenge for R & D work, which, once it has been clearly formulated and fully explained, finds a ready response—to judge from the Group's experience—in all sectors of society and particularly among the young. Its relevance, not only to problems of development in poor countries but also to problems of resource utilization and conservation, of maintaining or regaining ecological balance, and of achieving more satisfactory social structures than those promoted by the current trends towards giantism, is being increasingly recognized all over the world.

Assessing Technology for Development

Marc E. Schieber
New Technologies Section, Office for Science and Technology

"Technology assessment" has been attracting increasing attention of governments and the international community in recent years. In 1970, the UN Economic Commission for Europe (ECE) sponsored a seminar in Warsaw, Poland, on technological forecasting which considered the subject of technology assessment. The Organization for Economic Co-operation and Development (OECD) dealt with it in a seminar in 1972 and OECD science adviser François Hetman prepared a comprehensive study, *Society and the Assessment of Technology*,[1] for the Advisory Group on the Control and Management of Technology of its Committee for Scientific and Technological Policy. The OECD is now developing guidelines for use by its member states on the social assessment of technology.

Governments of industrialized countries, including Canada, the Federal Republic of Germany, France, Japan, Sweden, the United Kingdom and the United States, have taken a variety of actions ranging from the establishment of informal study teams to the setting up of special institutes and other bodies to perform the evaluative functions associated with the technology assessment process.

With this intensifying growth of activity, it is not surprising that more and more people are beginning to take an interest in this relatively new field.

What is Technology Assessment?

While technology has come to be recognized as one of the major forces in the modern development of nations, it has only been in the last few years that an awareness has emerged of the truly awesome impact technological growth can have on the nature of development within societies. For example, if we consider the decision taken by a number of industrialized countries to develop the automobile as the major technology for moving people, the implications of the widespread diffusion of this technology become significant indeed.

Initially, the automobile appeared to be a relatively cheap and convenient mode of transportation and, at the time, seemed to have an obvious advantage over the traditional system utilizing animal power, at least with respect to urban pollution. It held out the promise of economic benefits for countries in view of the need to establish numerous supporting and feeder industries throughout the society: the petroleum industry, the generation of an entire maintenance and repair industry, road construction and upkeep, stimulation of employment, the generation of income and tax revenues, etc.

However, when these decisions were taken and progressively implemented, no one bothered to consider the broader long and short term, social as well as economic effects that the establishment of the automobile as the mainstay of national transportation policy might have on their societies. But, as history has shown, the automobile has had an impact on society in many ways, most of them unanticipated.

People have now a means of travelling rapidly, easily, cheaply, privately, door-to-door. They tend to patronize stores at a distance from their homes, stores that are bigger, have more customers and are therefore more impersonal than the local stores. Within the community, residents do not meet all that often, they do not get to know each other well and therefore find it difficult to unite, to deal with common problems. Members of a family may work far from the community. On the one hand they become isolated from their neighbors; on the other, they may depend more on each other for satisfaction of their psychological needs and when they are unable to meet the demands each makes on the others, frustration occurs. The automobile also gives mobility to escape the pressures of family life. In the wider picture, people and commercial development flow from the cities and urban deterioration increases, as does carbon monoxide pollution. Concrete highways cover natural greenery vital to the earth's ecosystem and there is over-consumption of scarce, finite resources, especially oil.[2]

The case of the automobile is representative of hundreds or perhaps even thousands of other technological applications that have brought with them unanticipated and often undesirable social consequences. Having recognized these sometimes harsh realities through their own experience, several industrialized countries have taken the initiative in developing the evaluative tools and procedures that will enable them to establish more explicit policies for the regulation of technological growth and development so as to assure, at least to the extent possible, that the positive effects of technology can be maximized and the negative ones identified, minimized and, if possible, avoided. These efforts have formed the basis for what has come to be known as *technology assessment*.

Technology assessment, therefore, represents a conscious effort to produce objective, comprehensive data concerning the long and short term, planned and unforeseen, direct and indirect, social, ecological, economic and political costs and benefits which may accrue to a society if it adopts, purchases, develops a particular technology selected from a spectrum of possible choices. It is an evaluative process concerned less with the design of technology per se than with the effects a technological development or application may have on the many facets of societal life and national goals.

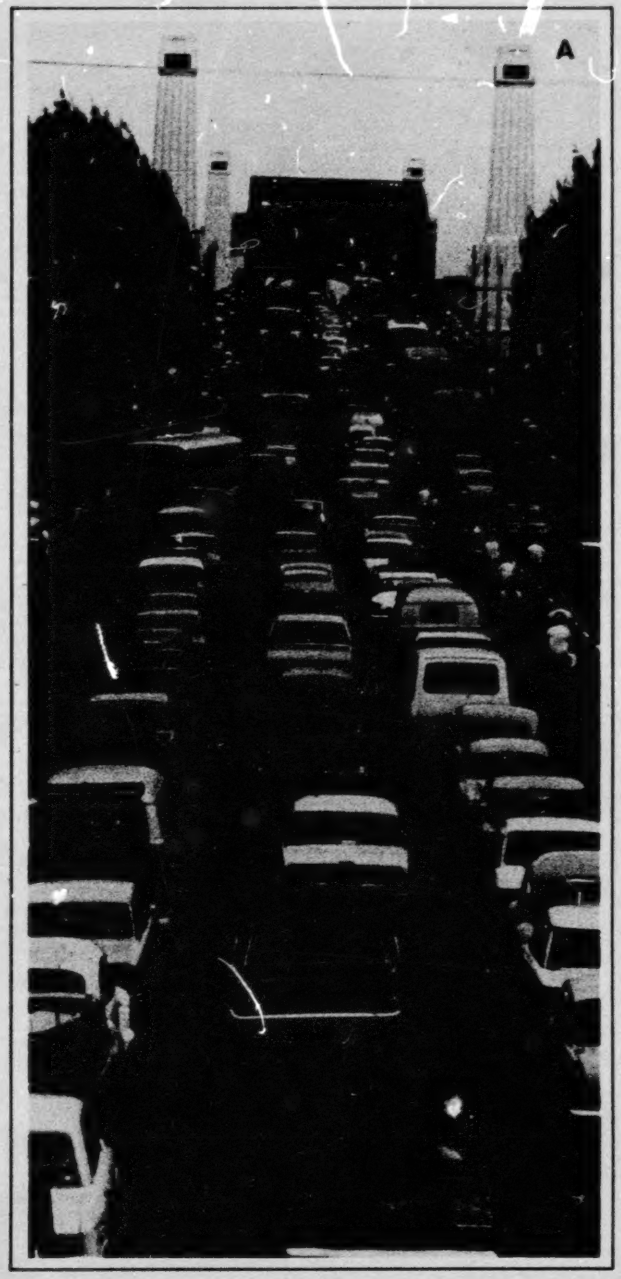
By the nature of its evaluative function, the assessment process employs an interdisciplinary approach to analysis. It brings together a variety of skills and provides a framework through which they can be effectively organized and can work in concert.

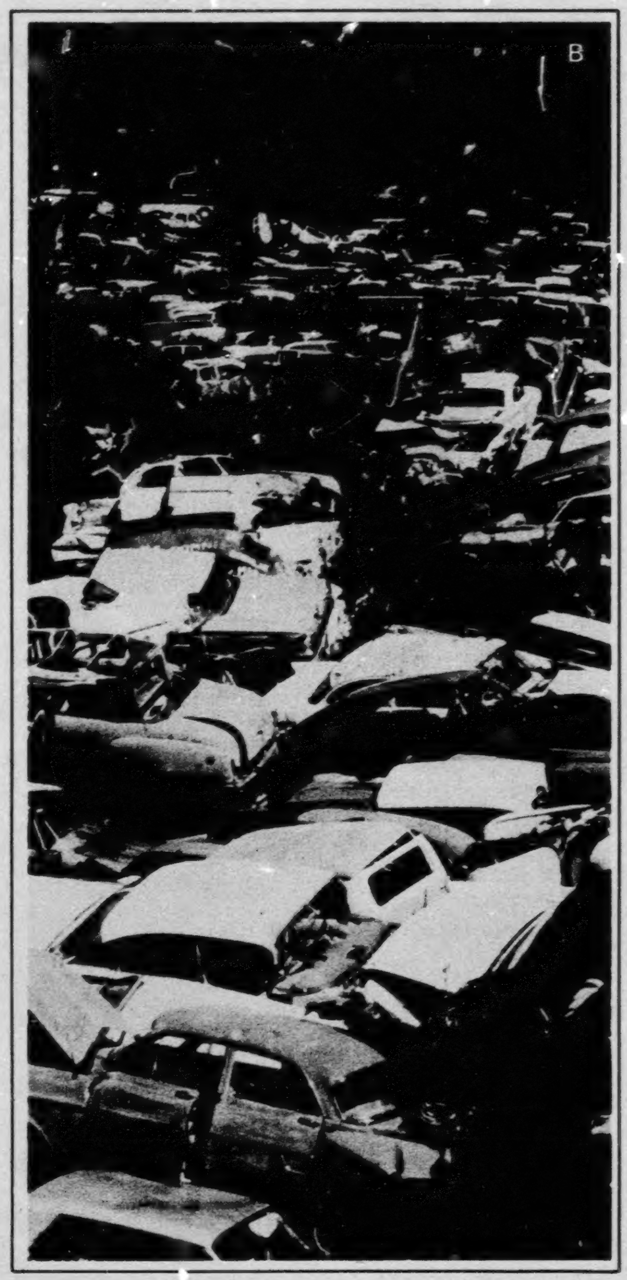
Assessment does not make ultimate decisions and is not a substitute for decision-making. Rather, it generates evaluative information concerning an array of alternative possibilities which can be used by decision-makers to make technology-related choices with a greater awareness of the potential consequences of their acts and a better understanding of the economic-socio-political trade-offs associated with each feasible course of action.

In essence, it represents an attempt to introduce a more rational process for controlling the nature of development by facilitating prudent investment of scarce resources in technological programmes that will provide maximum benefit to society as a whole while minimizing the risks of uncertainty with respect to the emergence of potentially undesirable and perhaps deleterious social impacts.

Technology assessment may thus be defined as "a form of policy research which provides a balanced appraisal to the policy-maker. Ideally, it is a system to ask the right questions and obtain correct and timely answers. It identifies policy issues, assesses the impact of alternative courses of action, and presents findings. It is a method of analysis that systematically appraises the nature, significance, status and merit of a technological programme."[3] In other words, technology assessment "is a class of policy studies which systematically examine the effects on society that may occur when a technology is introduced, extended or modified with special emphasis on those consequences that are unintended, indirect, or delayed."[4]

Several basic assumptions seem to form the conceptual foundations for technology assessment. These suggest that: a) technology assessment is a policy tool and is likely to be part of a series of interrelated studies; b) for effective policy formulation, it is necessary to organize certainty and uncertainty in order to define effective strategies for managing any particular technology; c) more information and analysis promote better decision making; and, d) in the long run, indirect and unanticipated effects of a technology are often more significant than the immediate planned consequences.[5]





Assessing Technology Continued

Although there are many ways in which technology assessment studies can be carried out, several procedural steps common to most are summarized below:

Steps in Technology Assessment[6]

1. Define the problem, the technology, issue or project to be assessed.
2. Identify the range of technological alternatives.
3. Identify possible consequences for society associated with each.
4. Evaluate these impacts with the aid of a variety of qualitative and quantitative tools.
5. Identify and define the appropriate decision-making authorities responsible for action with respect to the technology (e.g. public vs. private sector, national and international responsibilities).
6. Identify options for those authorities when taking action.
7. Identify parties who have a stake in the technology and the groups likely to be affected by its possible impacts.
8. Identify alternative routes to the goal.
9. Identify those changes in society, its goals, its orientation, or its technology which could have an influence on the primary technology or the factors interacting with it.
10. Conclusions and recommendations.

Within this general framework, the assessment process draws upon a variety of analytical methodologies and techniques in performing its evaluative functions. These include some that are familiar—cost-benefit analysis, systems engineering, technological forecasting, risk and probability theory, computer simulation and modelling, etc; and others that have a new look—the "delphi technique," which attempts to forecast trends and implications by scientifically collating the views of experts; the use of "cross-impact" matrices and analyses; and the development of "relevance trees." The arsenal of approaches available, therefore, represents a blend of the old and the new and draws upon sophisticated mathematical and quantitative techniques as well as systematic efforts to organize subjective knowledge and judgment.

Technology Assessment and the Developing Countries

The assement process has thus far become operative in the industrialized countries primarily because this is where the adverse social consequences of uncontrolled technological development have become most apparent. However, there is no reason to believe that the concept of technology assessment is of concern only to these societies. On the contrary, it is really the developing countries at the beginning stages of industrialization who are more urgently in need of evaluative skills in determining the most effective allocation of their scarce resources to those technological programmes and projects that can best meet their economic and social needs. Recognizing that the potential impacts on society of major technological programmes may go beyond those traditionally contemplated through economic analysis and technical feasibility studies, developing countries can avoid the mistakes in the pattern of technological growth and development that has characterized a number of the more advanced countries.

Those who are skeptical about the need for applying technology assessment in developing countries might take heed of an example linked to current events. Just a few years ago, one of the major aid agencies decided to support a project to improve the plight of the nomadic peoples of the Sahelian region. Since there was a general shortage of water in the region and an underground water-table had been discovered, the agency decided to construct some 1400 power-driven wells to tap the underground source and provide sufficient water for the inhabitants of the region. A most reasonable and pragmatic undertaking, so it would seem.

However, as history now records, these well-intentioned efforts went awry. With the increased water supply, the nomadic herdsmen no longer migrated with their herds of livestock to other watering places and pasture land but tended to remain at a well site. The size of herds increased, because of the now abundant water supply, but the pasture around the well began to disappear. In order to feed their herds, the nomads began to cut down trees and shrubbery so that the cattle could eat the leaves. This left nothing to hold the topsoil in place, the desert winds did their work and the Sahara began its most recent march. Soon the herds and their keepers and the keepers' families were faced with starvation. We know the rest.[7]

It is true that this process may have been only a contributing factor to a disaster that is probably closely linked to changing global climatic patterns, but perhaps its contribution was in fact significant. The tragedy is that apparently no one, neither the concerned government officials of the region nor the experts

PHOTO A: *Bangkok rush hour* **B:** *Automobile graveyard, USA* **C:** *Waterhole, northern Mauritania*
D: *Telecommunications Department training school, Ethiopia*

of the aid agency, took into consideration the likely social and cultural response of the herdsmen to the innovation. Apparently, no one recognized the need to take into account the migratory habits and customs of the region. Perhaps had an explicit assessment procedure been followed by the agency or the concerned governments, the worst consequences of this tragedy might have been anticipated and thus avoided.

A developing country need not utilize all the latest sophisticated computerized techniques in developing a capability for technology assessment. Methodologies can be adapted and scaled to meet the needs of specific countries. The important factor is the development of an explicit evaluative capability for assessing the needs of the country and the technologies that may be available for meeting those needs.

At the present time, many developing countries lack even a rudimentary capability of this sort. As a result, decisions concerning technology are often made by outside influences such as multinational corporations, technology salesmen and consultants trained in the requirements of industrialized countries, with little attention afforded to overall societal considerations and co-ordinated programming. Many developing countries in this position have virtually surrendered autonomy over key decisions concerning the development of their societies. Knowledge in a real sense is power. A society capable of assessing its own technological needs and the costs and benefits of potential technological alternatives to meet those needs will be in a far better position to assert or restore sovereignty over decisions concerning its technological, economic and social development.

The UNIDO Secretariat, in its report entitled *International Co-operation for Industrialization: Towards a New International Division of Labour,* prepared for the tenth session of the Committee for Development Planning, seems to support this view. It has suggested that developing countries should be assisted in establishing "efficient systems for the selection of foreign investment and controlling the impact of technology."[8] We might note that the type of evaluation capability that can most benefit a developing country is one that transcends strictly economic considerations and takes explicitly into account the potential socio-cultural impacts of alternative, feasible technological options.

In addressing the General Assembly's Second Committee in the fall of 1973, Philippe de Seynes, United Nations Under-Secretary-General for Economic and Social Affairs, took note of the importance of technology assessment in this regard.

> "The selection of optimum technologies in a set of given social, economic and cultural circumstances poses a different problem but one that is at least as complex as the problem of transfer. Technology assessment is a recognized but insufficiently evolved discipline. Scientific policy has, in most areas, been defined, but there are very few centres where a policy of technology is systematically elaborated on the basis of any systematic study of its impact and worth ..... The absence of sophisticated conceptual tools and of a reliable methodology makes it necessary to proceed by guesswork and a succession of approximations. In such situations, a truly comprehensive programme for study and experimentation is a necessity."[9]

While considerable international efforts are being devoted to the question of "appropriate technologies" for developing countries, particularly in the development, engineering and design aspects, little attention has been directed to assisting the developing countries to build their own evaluative capabilities. Despite this lack of attention on the part of the international community to date, there does appear to be a growing awareness of the importance of technological decisions in shaping the future development prospects of societies and, concomitantly, of the need for each society to possess a broadly-focused evaluation capability to facilitate the effective management of technology.

But there is more to the building of efficient mechanisms for the selection of technology and the allocation of resources to the creation of a local capacity than factor endowments, industrial information, engineering ability and industrial research. Important though these elements are, they are not sufficient in themselves to foster the growth of operational mechanisms. If a society is to establish an efficient system for the selection of technology, the key ingredient is the combination of human skill and a rational systematic framework through which information can be generated, integrated and assessed, so that the probable consequences can be planned for, the possible consequences taken into consideration and every allowance made for the unforeseen.

However good an information system for industrial technology or transfer may be, it by itself cannot advise a nation of the effects that a particular technological application might have on the many facets of that society. Each nation faces a different set of circumstances, needs, values and objectives; and, accordingly, each must consider and determine the potential effects and suitability of technology through the functioning of an indigenous evaluative process.

The significance of the automobile in the development of the industrialized countries and the well-intentioned technological undertaking in the Sahel serve as reminders of the tremendous importance that today's technological decisions will have for tomorrow's societies. It is with this new awareness and a sense of priority that the UN system must now begin to examine in depth the appropriateness of existing technology assessment methods and institutional approaches for developing countries, recognizing their particular needs and situations, and to develop the modalities through which it can assist governments who so desire how to develop and apply these evaluative tools in their own planning and policy-making.

[1] Francois Hetman, *Society and the Assessment of Technology*, OECD, Paris, 1973. [2] Derived from table in Joseph Coates, "Technology Assessment: The Benefits, the Costs, the Consequences", *The Futurist*, Vol. V, No. 6, December 1971. [3] Emilio Q. Daddario, Chairman, Subcommittee on Science, Research and Development of the Committee on Science Astronautics, U.S. House of Representatives, 90th Congress, 1st Session, Serial Revised, August 1968, p. 10. [4] Joseph Coates, "Some Methods and Techniques For Comprehensive Impact Assessment." Unpublished paper presented at the Engineering Foundation Conference on the Preparation of Environmental Impact Statements held at New England College, Henniker, New Hampshire, 28 July-3 August 1973, p. 1. [5] Ibid. [6] Derived from an article by Joseph Coates, op. cit., pp. 6-8. [7] Information derived from article by Martin Walker, "Drought," *New York Times Magazine*, June 9, 1974, pp. 11, 12, 42-46. [8] U.N. document E/AC.54/L.63. para. 44. [9] Statement by Mr. Philippe de Seynes, Under-Secretary-General for Economic and Social Affairs, to the Second Committee, 26 September 1973, OPI/CESI Note/195, p. 10.

Marine Resources and Ocean Space:

An Inductive Approach To Technology Transfer

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At a time of increasing concern about approaching scarcities of nonrenewable resources, of dislocation and hardship aggravated by energy shortages or high energy costs, of death and deprivation resulting from famine, and of general disappointment with progress achieved thus far under the strategy for Second United Nations Development Decade, which "remains more a wish than a policy,"[1] the importance of the benefits to be derived from marine resources and the uses of ocean space is receiving priority attention.

As an important source of hydrocarbons (68 per cent of the world's ultimate recoverable petroleum resources lies in waters of less than 200 metres in depth) and protein (about 15 per cent of total world protein consumption), ocean and coastal area resources offer at least a partial solution in the long-run to growing energy and food requirements. In the last decade, recognition of manganese nodules as a source of copper, nickel and cobalt has engendered an upsurge of exploratory and developmental activity. And, as acknowledged by the Economic and Social Council in 1973, the rational development of coastal areas, capitalizing on the growth opportunities inherent in marine resources and ocean space, could add a new dimension to the development of many developing countries.[2]

These considerations are directly responsive to many of the concerns expressed at the sixth special session of the General Assembly, on raw materials and development, held in 1974. While references to resources of the sea were conspicuous by their near absence at that high-level gathering, perhaps in deference to the then forthcoming Law of the Sea Conference, it is clear that any consideration of problems and projections relating to the world resource base must integrate marine resources with land-based supplies.

Whether and to what extent developing nations, and indeed many developed countries, will be able to benefit directly from the exploitation of marine resources and the uses of ocean space will depend in large measure on the effectiveness of marine technology transfer programmes.

Much valuable work has been done to illuminate the problem of technology transfer and to develop activities that are designed to promote such transfer. These efforts, however, have treated technology as an amorphous and undifferentiated commodity. Let us instead proceed on the premise that technologies may differ in a number of important ways and that the transfer process may be better served by focusing on specific sectors. The broad problems associated with any technology transfer would still be valid when applied to sectoral studies.

This inductive or "case study" approach has seldom been used.[3] In the field of marine technology, a first attempt to respond to this situation was made at the Third United Nations Conference on the Law of the Sea, which included "development and transfer of technology" as one of the subjects on its agenda. At the Conference's Caracas session, a background paper dealing with some of the basic issues of the transfer of marine technology was prepared by the Secretariat.[4] A further study on some of the selected issues is being prepared for its Geneva session in 1975.

"Marine technology" is itself an abstract term. It becomes significant only when it is related to the equipment and technical know-how employed in specific marine activities. For all practical purposes, the term may be understood to mean the body of knowledge and the hardware needed for using ocean space and for surveying and developing marine resources. The accompanying table lists some of these activities.[5]

Technology transfer involves at least two distinct stages: firstly, the acquisition of the necessary and appropriate technology; secondly, the implantation of such technology, that is, to get a specific industry working in the recipient country whilst enabling that country to achieve a certain amount of technological autonomy in terms of skill, know-how and trained personnel so that it can apply the technology effectively and make its own decisions, fully aware of what is available. The question of acquisition has received much attention. More study is needed on the ways and means of successful implantation, so that a country does not find itself locked in further dependence.

Although many marine activities such as fishing and transport have long histories, further development and better application remain a priority even among the technologically more advanced countries. Certain uses of ocean space (e.g. for waste disposal) have only quite recently assumed importance, some new technologies such as desalination are already in the stage of advanced application, and activities such as offshore drilling are being modified to adapt the requisite technologies to deeper water and more extreme environments. Still others, such as deep sea mining, are new activities born of more recently defined needs and are being developed on the basis of modern technological advances. Gaps and inadequacies are not uncommon in marine technology, although the extent of the deficiency may vary from one industry to another. The need for marine technology transfer also exists even among developed countries, particularly in regard to such activities as deep sea mining. There is, therefore, a need to promote the development of marine technology in general.

Then there is the question of adapting existing knowledge. Since much equipment and machinery have been designed for use under certain conditions and the application of equipment and know-how is affected by the environment in which it is applied, it cannot be assumed that a technology which has developed in one area can be effectively applied in another area without adaptation. For example, drilling rigs designed for use in the Gulf of Mexico are less suited to the hostile environment of the North Sea. Such rigs may also be less than ideally suited for use under the different economic, social, technical, physical and other conditions in any given developing country. These

MARINE ACTIVITIES

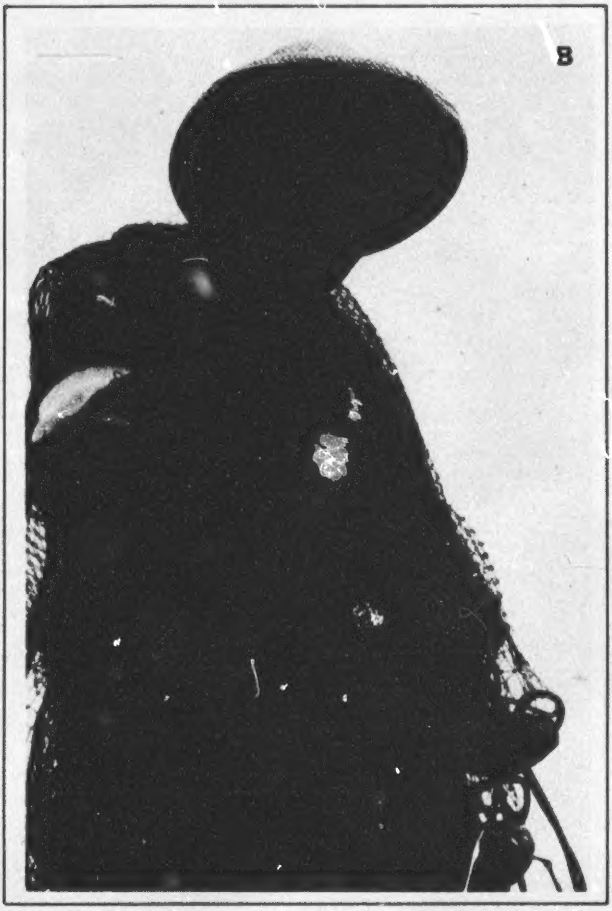
Exploitation of marine resources	A. living resources	a. fisheries (e.g. fish and living organisms of the sedentary species) and plants b. aquaculture (e.g. oysters, sea weeds, shrimp, salmon, etc.) c. extraction of drugs
	B. mineral resources	a. deposits within bedrock (e.g. oil, gas, sulphur, coal) b. surficial and placer deposits (e.g. sand and gravel, phosphorite, iron ores, manganese nodules, tin, gold, etc.) c. extraction of dissolved chemicals (e.g. salt, magnesium compounds) d. desalination
Uses of the ocean space	A. off-shore structures	a. structures supporting an exploitation process (pipelines, storage tanks, mooring and loading buoys, terminals, etc.) b. structures which can conveniently locate facilities offshore (artificial islands, floating airports, floating (nuclear) power stations, undersea habitat, etc.) c. structures crossing stretches of water (bridges, pipelines, cables, tunnels, etc.)
	B. transport	a. ports b. tankers c. bulk carriers d. conventional and container ships
	C. generation of energy	a. tides b. waves c. ocean currents d. thermal gradients
	D. others	a. recreation b. land reclamation c. waste disposal d. marine research

factors increase the difficulty in marine technology transfer.

Different marine industries face different problems, depending on the nature and characteristics of the industry. Generally speaking, technology requirements become more stringent, complex and demanding as water depth increases and as the activity extends farther from shore. Thus, deep sea mining of manganese nodules involves far more sophisticated equipment and technical knowledge than near shore sand and gravel extraction; pelagic fishing requires larger and more advanced facilities than coastal fishing. As technology becomes more sophisticated, the operation also becomes more capital intensive. This is a factor which must be duly recognized in selecting marine industries for development.

Within each marine industry there are different ways to develop, and different levels of technology can be applied. It is not always possible to determine in advance which might produce the best results, though some methods are more suitable than others in certain situations. In fish farming, for example, the completely enclosed systems used in some countries for the cultivation of plaice are capital intensive and therefore most suitable for industrialized countries; on the other hand, systems for fertilizing coastal water or for farming in lagoons or coastal waters using simple enclosures which involve only moderate investment but considerable labour may be suitable for the labour intensive economies of many developing countries.

Certain marine activities—for example, surveying the distribution of manganese nodules on the ocean floor—require inputs from a variety of disciplines, advanced technology and large long-term investment with no immediate return. Highly sophisticated instruments are required to obtain accurate records of the ship's position when photographs or samples are taken. At the production stage, it has been reported that the construction of a commercial-scale nodule mining system and metallurgical plant could cost more than $200 million.[6] A self-elevating, jack-up type of offshore drilling platform designed to operate in water depths up to 250 metres under hurricane conditions would cost US $25 million (if built in the United States). Daily cost for operating and supporting one of the new semi-submersible rigs total about $50,000.[7] On the other hand, certain uses and activities such as sand dredging or construction of offshore terminals require more modest investment and could be carried out in many cases with an intermediate level of technology.



Successful transfer presupposes that the recipient country has the capability to determine what is needed and subsequently to apply the technology acquired. Selection involves first determining the nature and extent of available resources and then, guided by this survey, a decision regarding the kind of marine industry to be developed (e.g. offshore gas). The country must identify the priority areas where specific technologies are needed (e.g. pipe installation) and obtain the appropriate know-how and machinery to carry out the project. Due to generally lower levels of economic activity and technological sophistication and to the scarcity of skills, developing countries are often inadequately equipped to meet these requirements. Moreover, they often lack essential information (e.g. state of the art and knowledge of the firms and companies capable of providing the service or equipment) upon which some of these decisions must be based. Even when the required technology is made available, there are still problems of operation, management and marketing to overcome.

In projects involving scientists from various disciplines and large-scale equipment and machinery (as in the nodule mining industry), freedom to seek different sources of development assistance tends to be limited to the early stages of the project. Moreover, since advanced technologies, such as those for deep sea mining, are in the hands of a small group of companies operating on a multinational basis,[8] the bargaining advantage is likely to be on the side of the supplier.

The question of implantation poses special problems for those marine activities requiring a high level of technology. Perhaps with the exception of sand and gravel dredging, activities involving mineral resources exploitation generally require a high or a very high level of technology, specialized personnel (e.g. marine geologists, drilling experts and civil mechanical engineers), heavy equipment and machinery, and a large financial investment. For many developing countries, a possible way to meet the technological and financial requirements on a more reasonable time scale may be to seek co-operative ventures with foreign entrepreneurs. This method could provide the host country both with an opportunity for direct participation in resource exploitation and with the required technological know-how, machinery and capital. During the recent sixth special session of the General Assembly, several delegates commended this approach and pointed out specifically that this technique could be beneficial in regard to the interchange of relevant technologies.

Since uncontrolled foreign participation and investment in local enterprises is often regarded as undesirable on economic and political grounds, it is important to consider effective control measures. These measures might, for instance, take the form of limits on foreign shareholding and of laws and regulations prescribing the conditions under which external enterprises are allowed to operate.

While external participation and investment may appear to be an effective means for mobilizing technology and finance, it does not necessarily follow that the technology is automatically *transferred* to the host country. Measures for realizing the actual transfer to the host country—that is, its implantation—must be taken. One possibility is to provide an effective built-in mechanism in the co-operative arrangement. This

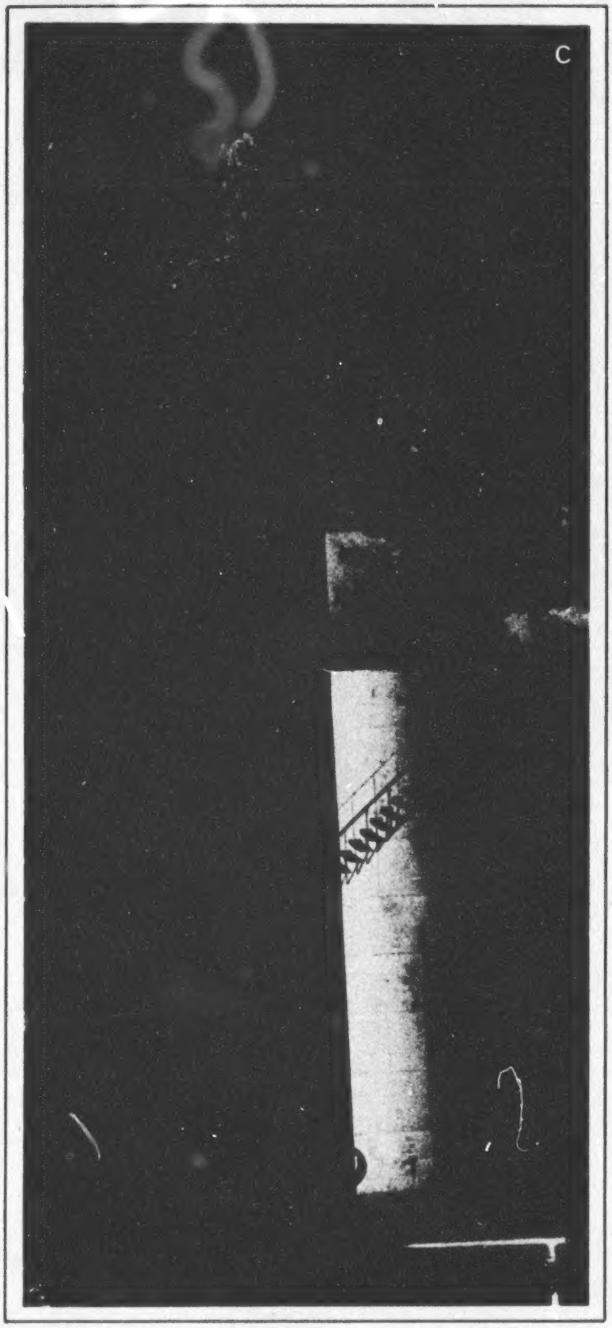


PHOTO ***A:*** ***(photo: Y. Ripplinger)*** ***B:*** ***Gillnet used for fish-farming in the Philippines*** ***C:*** ***Petroleum storage tanks***

may include at this initial stage: (a) the obligation of foreign entrepreneurs to organize programmes for training host country staff to become competent technicians and managers; (b) a gradual and systematic replacement of the foreign personnel by local staff, and (c) a gradual reduction in the shares held by external participants. These and other measures could be introduced to ensure and increase participation of developing countries in the conception. construction, organization and management of the enterprises.

Over the longer run, successful implantation of marine technology requires a wide range of techniques and skills. Basic research in pure and applied sciences is required. For example, an understanding of fluid mechanics is essential in designing onshore and offshore structures subject to wave and current forces and for the hydraulic lifting of surficial deposits; underwater acoustics are important in the location and identification of mineral deposits and in fishing. Knowledge of mechanical, electronic and civil engineering is essential for technological design, construction, operation and maintenance of platforms and other elements in resources exploration. Finally, there is the need by the users of technical hardware and manpower; for expertise and equipment according to the activity, whether manganese nodule mining, aquaculture, fishing or shipbuilding; for coping with the physical conditions of the environment—depth of water, nature of sea-bed, waves and weather; for technical and financial capability.

In some cases, if the transfer of technology is too quick, the recipient country may not obtain the maximum direct financial benefit from the exploitation of the marine resources. More effective transfer may result from slower development or from the use of less sophisticated and cheaper technology.

Although certain aspects of marine industry such as fishing and navigation fall within the competences of several of the UN's specialized agencies, the level of activity is still limited. Moreover, many new areas of marine exploitation (offshore oil and gas, deep sea mining, extracting dissolved chemicals) and the uses of ocean space (pipelines, terminals, storage facilities) remain outside the scope of existing mandates.

In these marine subsectors particularly, there is obvious need to devise a broad spectrum of specific measures for transfer, comprehending the various components associated with the transfer process and designed to stimulate action at various levels—nationally, regionally, and through the United Nations system. The report now in preparation at the United Nations for the Geneva session of the Law of the Sea Conference is intended to help meet this need.

The foregoing has a two-fold purpose. First, to advocate the need for an inductive approach for improving the transfer process in a particular technology sector. This method could be applied to other sectors of interest to the UN, e.g. computer, energy, and space communication technologies, Secondly, to emphasize the importance of technology implantation, an integral component of transfer. Such transfer will be incomplete and even counterproductive over the long run unless there is a receptive environment capable of sustaining and nourishing the imported technology until it puts down deep roots in its new soil.

[1] General Assembly resolution 3176 (XXVIII), 17 December 1973 [2] Resolution 1802 (LV), 7 August 1973 [3] An exception is the UNITAR case study series on automotive technology, petrochemical industry and pharmaceutical industry, see UNITAR Research Reports, Nos. 7, 13 and 14. [4] A/CONF.62/C.3/L.3 [5] This table is adapted from "Problems of acquisition and transfer of marine technology", Conference on the Law of the Sea, A/CONF.62/C.3/L.3, p. 7 [6] "Sea-bed mineral resources: recent developments", progress report by the Secretary-General, A/AC.138/90, 3 July 1973, p. 12 [7] *Ibid.*, p. 6 [8] These include, for example, Summa Corporation (ex-Hughes Tool Corp.); Kennecott Copper Corporation; Deepsea Ventures Inc. (an affiliate of Tenneco); International Nickel Corporation; Summitomo Group/MITI; Arbeitsgemeinschaft fur Meerestechnisch-gewinnbare Rohstoffe, Federal Republic of Germany; Centre National pour l'Exploitation des Océans (CNEXO) and Societe de Nickel of France. For their recent activities see "Economic implications of sea-bed mineral development in the international area: Report of the Secretary-General", A/CONF.62/25, 22 May 1974, pp. 12-22.

The Technological Dependence of Developing Countries

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Major Problems Of Technological Dependence

Technological dependence is a relatively new subject for both governments and international organizations. Understandably, there is a serious lack of empirical evidence, particularly as agreed coverage and definition of the items to be included in the foreign-exchange costs of transfers remain to be worked out. But although the available data vary widely in scope and comparability, an attempt is made here to assess the major issues which arise from such dependence. As a more detailed understanding of the process and implications of the transfer of technology to developing countries is obtained, the actual shape and size of the problems they have created will have to be re-defined with greater precision.

Technological intensities of industry

The UNCTAD secretariat has recently tabulated information on the distribution of industries in respect of more than 7,500 contracts concerning the transfer of technology.[1] Data for 13 developing countries showed that 57 per cent of the agreements in manufacturing were in the modern sector (which includes all chemicals, petroleum refining, instruments, machinery, and equipment), 26 per cent were in the traditional sector (food, tobacco, textiles, clothing, leather, wood products, paper and printing, stone, clay and glass, fabricated metal parts), and 17 per cent were in 'other manufacturing,' a miscellaneous sector (including cosmetics, rubber goods, ferrous and non-ferrous metals).

The share of the modern sector in the total number of contracts ranges from only 20 per cent in Dahomey, which is one of the least developed countries, to 81 per cent in the Republic of Korea, a major exporter of manufactured goods. This high concentration of agreements in the modern sector does not necessarily indicate an extensive use of advanced technology. The degree of technological sophistication is often low, as with pharmaceuticals, electrical appliances, and automobiles, where most of the operations consist of the assembly, mixing or combining of imported components. On the other hand, the widespread prevalence of such agreements in the traditional sector, using relatively simple standardized technologies, suggests scope for the reduction of dependence in these industries.

Organizational forms for importing technology

It is possible to distinguish three major ways of organizing the transfer of technology: by enterprises which are *either* nationally owned, *or* whose majority equity capital is domestic *or* foreign. The predominance of one or other of these types of organization in different countries depends on the particular socio-economic and political circumstances, and on the nature of legislation governing the ownership of enterprises. A combination of organizational forms for the transfer process has emerged, and there are wide variations from country to country. In Cyprus, Colombia and Brazil between one-third and one-half of the agreements which involve some form of technology transfer were made by enterprises with majority foreign equity. For Korea, Pakistan, India and Yugoslavia, this proportion ranges from one-seventh to nil.

The forms of transfer to developing countries have changed over the years. In the early phase of industrialization, most of the undertakings using modern technology were completely owned and controlled by foreign interests. The creation of domestic capital resources, skilled indigenous manpower, a new class of entrepreneurs, and national policies for industrialization and development all appear to have strengthened local participation in key enterprises. Thus, the more developed a poor country becomes, the greater the scope for increasing its technological independence.

Direct costs of technological dependence

The sale of technology is a complicated transaction in which the charges are rarely, if ever, clearly stated. For subsidiaries of multinational corporations, most of the arrangements for the transfer of technology are implicit; usually, they do not form part of any written agreement. On the other hand, when joint ventures or independent enterprises wish to import a new technology, this is usually affected by an explicit agreement. For these reasons, only limited progress has been made in estimating the financial implications of these transfers.

Direct costs consist of payments for the right to use patents, licenses, process 'know-how,' and trademarks, and for technical services needed at all levels, from the pre-investment phase to the full operation of the enterprise. The information available here is very inadequate. Provisional estimates by the UNCTAD secretariat indicate that in 1968 the developing countries paid out about $1,500 million in foreign exchange on these direct costs, which are forecast to rise by about 20 per cent per year, or to increase sixfold, i.e. to $9,000 million, by the end of the 1970s.

The relative burden of the current direct costs would be better appreciated if they are compared with other magnitudes in the developing countries. They were equal to (i) 5 per cent of net investments; (ii) 8 per cent of imports of machinery and equipment (excluding passenger vehicles) and chemicals; (iii) 37 per cent of service payments on external public debt; (iv) 56 per cent of the annual flow of direct private foreign investment, including reinvested earnings; and (v) two and a half times the domestic expenditure on research and development.

These are indeed very high burdens. They arise from the weak bargaining position of most of the developing countries. External enterprises succeed in obtaining effective royalty payments which range as high as 10-30 per cent of the value of sales; and salaries for their consultants, in some instances, are as much as 50 times those paid to local personnel undertaking similar work. When the negotiating position of the developing countries is strengthened, this usually leads to a considerable lowering of both these ranges.

There is another aspect concerning the direct costs of technological dependence which may merit discussion. As pointed out already, they amounted to two and a half times the domestic expenditure on research and development (R & D). These two together were responsible for 0.7 per cent of the G.N.P. of the developing countries. Considerable attention has recently been paid to the need for raising their R & D expenditures. It is well to keep in mind, as pointed out by J. D. Bernal, that these amounted to less than 0.1 per cent of the G.N.P. of even the most advanced country up to the beginning of the present century.[2] The sums the developing countries currently spend on imported technology and R & D are thus relatively so large that assuring their most efficient utilization plainly assumes major significance.

Indirect costs

So far we have only considered the tip of the iceberg. The hidden portion forms a much larger part of the total, since heavy indirect costs are borne in various ways. Chief amongst these are payments through (i) over-pricing of imports of intermediate products and equipment; (ii) profits on capitalization of know-how; (iii) a portion of repatriated profits of the wholly owned subsidiaries or joint ventures; and (iv) price 'mark-ups' for technology, included in the cost of imported capital goods and equipment.

These indirect costs are indeed difficult to measure in absolute figures. Much more systematic work needs to be initiated before definite evidence can be produced. In the meantime, illustrative data have recently been developed on the first item in this list. The practice is very widespread of including specific clauses in transfer agreements which limit the purchase of certain imported inputs to the technology-suppliers themselves, or to sources designated for this purpose. Such specific tie-in purchase clauses are not even necessary in the case of direct private investment

A study prepared for the third UNCTAD Conference showed that in the Colombia pharmaceutical industry the absolute amount of 'hidden' costs, incurred through overpricing of intermediate products, was equivalent to 6 times the royalties and 24 times the declared profits of foreign firms. A sample of the same industry in Chile indicated overpricing of imported products in excess of 500 per cent, while in Peru the range was between 20 and 300 per cent. In every case, the overpricing by foreign firms was much greater than that by nationally owned enterprises.[3]

In the Andean Pact countries—Bolivia, Chile, Colombia, Ecuador, and Peru—similar evidence is available in other industries, including electronics, rubber, and chemicals. And the phenomenon of overpricing is not confined to this part of the world alone. Preliminary research in Mexico, India, Ethiopia, and Spain, to name just a few other countries, shows that the same kind of practice is occurring there also. It should be clear that wherever it is feasible for foreign firms to use this channel of collecting returns, and that it is in their interest to do so, then there is an *a priori* presumption that overpricing will be used as far as possible.

It is hard to generalize on the basis of such limited evidence. But in any future attempt at making a global estimate it is obviously important to keep in mind the following fact: that in 1969 the developing countries imported crude materials, machinery, and equipment which amounted to nearly $30,000 million. Even if the minimum level of overpricing indicated above were to apply to only a part of this grand total, the costs incurred by the developing countries through overpricing could indeed by quite substantial.

Other costs

Beyond direct and indirect costs, there are other 'not easily perceived' real costs, or benefits foregone, which are qualitatively of major significance. They result from (i) limitations imposed in transfer arrangements; (ii) the transfer of wrong or inappropriate technology; (iii) inadequate or delayed transfer; (iv) the 'non-transfer' of technology; and (v) the long-term influence of imported technology on deflecting national policies away from a sound development of local technological capabilities. These are areas to which little serious consideration has been devoted so far, and the range of implications has hardly been explored, let alone quantitatively measured. Therefore the thoughts presented below on some of these issues are meant merely to initiate discussion.

Apart from the limitations concerning tied purchases, transfer agreements may also contain other types of restrictions: (i) on exports, from total to partial prohibition, including geographical restraints; (ii) on changes in taxes, tariffs, and exchange rates affecting profits, royalties, and remittances; (iii) on competing supplies and local resources, designed to reduce or even to eliminate competition; and (iv) on the dynamic effects of the transfer through the excessive use of expatriate personnel, and the discouragement of local technical and R & D capabilities.

The patent system is perhaps of crucial significance for appreciating the incidence of 'other costs.' Of the 3 million current patents in the world, around 30,000—barely 1 per cent of the total—are held by the nationals of developing countries. And these are mostly for inconsequential items, such as hairpins and lotions; the rest belong to the nationals and enterprises of the developed countries. Of all the relationships between rich and poor nations, the patent system is the most unequal. Outsiders hold patents in the Third World mainly to discourage their use in production processes.[4] The monopolistic advantage thereby gained—the source of major profits—operates in reality as a reverse Generalized System of Preferences—granting preferences to outsiders in the economies of the developing countries. It is indeed a perverse irony that this is done through patent laws enacted by the governments of these countries themselves.

Quite clearly these restrictions impose severe burdens. Some of them, by limiting export possibilities, constrain efforts at regional economic co-operation and the benefits to be gained from the introduction of the Generalized System of Preferences. Others adversely affect the formation of skilled personnel, domestic R & D, and the emergence of integrated national policies on key questions. Methods remain to be devised whereby at least the order of magnitude of their costs can be given. It is also important that national, regional, and international steps be taken to ensure that the adverse effects of these limitations are removed, or at least alleviated, as soon as possible.

Considerable work has already been done on the transfer of wrong or inappropriate technology and of inadequate or delayed transfer. It needs no emphasis that each of these also involves major costs, or benefits foregone.

Cost of 'non-transfer'

This is a sensitive area which is usually overlooked through what Gunnar Myrdal has aptly termed 'diplomacy by definition'. Once a plant is located in a developing country, it is generally believed that a transfer of technology has taken place. But in many cases the location is solely based on the fact that the country possesses a particular resource endowment—for example, mineral deposits or climatic conditions. The basic elements of the technology connected with the operation of the plant are not transferred at all to the nationals of the country concerned. Here is in reality no transfer of technology.

The petroleum industry is a classic example of such a practice—but not the only one. For instance, most of the mineral-ore processing and metal-producing plants come into this category, as do plantations and even industries employing such traditional and well-known technology as textile manufacturing. In all these cases, what are euphemistically called payments for the 'transfer' of technology are really payments for the 'non-transfer.' This is yet another area awaiting careful research.

Main Lines Of Action

As reviewed above, the costs to the developing countries of their technological dependence are very heavy indeed. Much remains to be done to measure them more accurately, and even then some of the items involved may never be satisfactorily estimated. At a guess, however—submitted here as an unverified hypothesis—these costs might amount annually to $6,000 or $12,000 million, or somewhere between 2 and 4 per cent of the national income of the developing countries, excluding socialist East Asia. In comparison, they spend around $600 million—only one-tenth to one-twentieth of these costs—on research and development.

The choice between absolute external dependence and mainly 'going it alone' is thus neither an empty argument among irritable academics nor a silly self-glorification by foolish politicians. It is plainly a crucial choice to be guided mostly by common sense, simple arithmetic, and perhaps some economics. It is not surprising, therefore, that the clearer the issues have become, the stronger have been the pressures for national, regional, and international action.

An international code of conduct

Quite clearly a new network of laws, regulations, and special institutions has begun to be established in the developing countries. All of these, by and large, are in line with decisions taken at the third UNCTAD Conference, notably resolution 39 (III), which might well be called the 'Santiago Charter,' for improving the access of the developing countries to technology. This new situation, however, may encourage conflict concerning the interpretation of contractual arrangements and may make the settlement of disputes more difficult. An internationally co-ordinated approach, therefore, aimed at establishing an orderly way of dealing with these complex problems, is of crucial significance.

It appears that the steps now being taken are having their effect on technology-supplying enterprises in the developed countries. In the first place, there has been considerable discussion in recent years on arrangements which have come to be known as 'fade-out' policies. These require a slow but systematic reduction in the share of foreign-owned equity in developing countries, thereby helping to ensure increased local participation in the conception, construction, organization and management of their own enterprises. The greater the success in this direction, the larger the 'unpackaging' of foreign investment from essential technology.

Another development of some significance has been the publication of 'Guidelines for International Investment' by the International Chamber of Commerce in November 1972. These deal not only with foreign investment, but also specifically with 'technology (including inventions and know-how skills)' and related problems of ownership and management, fiscal and commercial policies, and the legal framework. The I.C.C. recognizes the need 'to foster better understanding of the rights of both host and capital-exporting countries, as well as of individual investors,' and explains the purpose of its contribution thus:

> these Guidelines will be helpful to the United Nations and other intergovernmental organizations in their efforts to promote constructive discussions on the relationships between international investors, the governments of host countries and the investor's governments.[5]

These moves seem to have set the stage for the establishment of a truly international code of conduct for the transfer of technology. In the words of the Secretary-General of UNCTAD in his 'Review and Appraisal of the Implementation of the International Development Strategy':

> The time would appear to be ripe for the international community to distil the lessons of this experience and to work towards designing an international code of conduct in this field which might benefit all countries, particularly the developing countries.[6]

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[1] For details, see "Major Issues Arising from the Transfer of Technology to Developing Countries", Geneva, December 1972, UNCTAD documents TD/B/AC.11/10 and Add. 1 [2] For details on the number of scientists and associated expenditures, see J.D. Bernal, *Sciences in History* (Harmondsworth, 1969), vol. II, p. 609, and vol. III, p. 714. [3] "Policies Relating to the Transfer of Technology of the Countries of the Andean Pact: their foundations", a study by the *Junta del Acuerdo de Cartagena*, November 1971, TD/107. [4] See Edith Tilton Penrose, *The Economics of the International Patent System* (Baltimore, 1951), and "International Patenting and the Less Developed Countries", in *The Economic Journal*, LXXXIII, September 1973; also Ulf Anderfelt, *International Patent Legislation and Developing Countries* (The Hague, 1971). [5] International Chamber of Commerce, *Guidelines for International Investment* (Paris, 1972), introduction. [6] "Review and Appraisal of the Implementation of the International Development Strategy: Report by the Secretary-General of UNCTAD", Geneva, March 1973, para. 103. Extracted from an article in *The Journal of African Studies*, Vol. 12, No. 1, 1974, published by Cambridge University Press.

Transfer of Technology: A Code of Conduct

Over the years, Pugwash Conferences on Science and World Affairs have brought together over seven hundred eminent and influential scholars and scientists from about fifty countries to discuss crucial problems relating to world security and arms control, scientific co-operation and education, environment and resources, population and the social responsibilities of scientists. In September 1973 the Pugwash Conference met in Finland, and one of the working groups considered the Social, Economic and Political Barriers to the Application of Science and Technology to Development. It recommended that a working party of experts be set up to draft a code of conduct for technology transfer. A group of fifteen specialists, acting in their private capacities, met in Geneva from 1-5 April, 1974 and drafted a code defining the obligations of suppliers and receivers of technology, with the deliberate aim of strengthening the bargaining position of developing countries in international technology transactions.

The report of the Pugwash group of experts was circulated at the July 1974 session of the UN Conference on Trade and Development in Geneva at the request of the Permanent Representative of Algeria, in his capacity as Chairman of the Group of 77.

The Intergovernmental Group on Transfer of Technology, meeting from 15-26 July, passed resolution 3 (III) on "The possibility and feasibility of a Code of Conduct in the field of transfer of technology."[1] The resolution considered that an international code of conduct in the field of transfer of technology may indeed be possible and feasible and called for the convening of an intergovernmental group of experts to prepare a draft outline which could form a useful basis for preparing a universally applicable code of conduct in transfer of technology corresponding to the needs and conditions in developing countries.[2]

The following summarizes the main points of the report prepared by the Pugwash working group on the transfer of technology.

Access to modern technology is one of the basic conditions for development. Although technology transfer mechanisms differ according to political and economic systems, the barriers to technology are primarily related to technology owned by its producers in developed countries, under patents and industrial property legislation. Such technology is introduced into developing countries in many forms: in conjunction with direct investment, in the form of capital goods exports or through the licensing of patented technical knowledge to local firms.

This proprietary technology sold to developing countries tends to support primarily the interests of capital and technology suppliers, whether governments or private firms, in developed countries. Since such technology is rarely subjected to adaptation to local conditions (the size of the market and production factors, among others) by the sellers, its impact upon the building up of the development potential of the developing countries, particularly in the science and technology field, is often negligible and sometimes even negative. Many developing countries lack relevant information for choosing appropriate technologies and often receive advice biased towards the use of capital-intensive technologies, to the detriment of the obviously desirable objective of expanding overall employment. The question of importing and applying technologies that would fortify technical capabilities and create employment at the same time becomes a crucial element of overall development strategies. The solution of this problem is not facilitated by the empirically proven fact that foreign investors and technology suppliers tend to concentrate all their research and development in their home countries and thus hinder the growth of local research and development efforts in the developing countries.

The financial terms, as well as restrictive clauses imposed in technology purchase contracts, also constitute a heavy burden. The norms applied in the technology trade between developing countries should be enforced in technology trade transactions between the developed countries and the developing countries. National legislation, known as antimonopoly laws, has existed for a long time to defend the society, the technology buyers and the consumers against possible abuses on the part of powerful producers of modern technology.

In the light of the existing international situation, there is an urgent need for a Code of Conduct to govern international technology transactions. Initiatives to establish such a code, made on various occasions in UN agencies, have encountered strong opposition in some key Western technology producing countries.

A Code of Conduct for technology transfer that would take into account the legitimate rights of the proprietary technology owners and the needs of developing countries' technology buyers would be enforced by the governments of the developed countries of all economic systems in dealings of their nationals with the developing countries, and by the governments of developing countries as well. While a code should be elaborated at the international level within the UN family, it cannot be successful unless it receives the support of the international scientific and technological community. Since the demand for technology in the developing countries is steadily increasing and the foreign sellers of proprietary technology are receiving fairly good profits from their transactions with the developing countries, there are no reasons to believe that the elaboration and international enforcement of the above-mentioned Code of

Conduct would hinder the flow of foreign technology to the developing countries. On the contrary, it is quite probable that it would enhance the developing countries' overall ability to purchase foreign technology under more equitable conditions. Such development would, in turn, make easier the task of incorporating that technology into the domestic production systems and would establish the conditions propitious for the creation of local technological capabilities.

On the national level many moves aimed at improving access to information about the state of the international technology market are being taken in Latin America and some Asian and African countries. Unfortunately, relatively little effort has been made with respect to technological needs of many smaller developing countries. Unless they group themselves together and work out regional science and technology policies, they face the danger of misallocating their scarce human and financial resources without improving their bargaining positions *vis-à-vis* powerful technology producers in the developed countries.

EXCERPTS FROM THE DRAFT CODE OF CONDUCT ON TRANSFER OF TECHNOLOGY

prepared by the Pugwash working party of experts

Objectives and principles

i) to establish general equitable rules of behaviour in the international technology markets taking into consideration particularly the justified needs of developing countries and legitimate rights and obligations of technology producers and suppliers and technology recipients;

ii) to make clear the distinction between proprietary technology and freely available technology and reflect this distinction in terms and conditions of technological transactions;

iii) to foster the expansion of international trade in proprietary technology on terms mutually beneficial to suppliers and recipients by eliminating restrictive technology trade practices and regulating monopolistic rights accruing to some proprietary technology owners for the purpose of assuring the strengthening of the negotiating power of developing countries;

iv) to ensure fair pricing of technology trade transactions, by assessing all direct and indirect costs to the recipients and profits to the suppliers, and taking into consideration, *inter alia*, the duration of a contract and the dynamics of technological progress;

v) to introduce as a minimum the most-favoured-licensee clause in the international technology trade transactions involving developing countries;

vi) to expand free flow of non-proprietary technology on a non-discriminatory basis and through appropriate channels and mechanisms to suit the requirements of developing countries;

vii) to ensure the responsibility of suppliers and recipients to adapt technological trade transactions and flows of freely available technology to factor proportions of the countries with different development levels and to their local development needs and absorptive capacity;

viii) to increase the contribution of technology, under specially favourable conditions, for the solution of pressing social problems in developed and developing countries; and

ix) to ensure that technological transactions entail the strengthening of local technological capability of developing countries, which would permit their endogenous technological dependence upon the outside world and assuring their increasing participation in world technology production and trade. . . .

Guarantees

The supplier shall guarantee that:

i) the technology acquired is in itself suitable for manufacture of products covered by the agreement;

ii) the content of the technology transferred is in itself full and complete for the purposes of the agreement;

iii) the technology obtained will in itself be capable of achieving a predetermined level of production under the conditions specified in the agreement;

iv) national personnel shall be adequately trained in the operation of the technology to be acquired and in the management of the enterprises;

v) the technology is the most adequate to meet the particular technological requirements of the recipient given the supplier's technological capabilities;

vi) the recipient shall be informed and supplied with all improvements on the techniques in question during the lifetime of the agreement;

vii) where the recipient of the technology has no other technological alternative than acquiring capital goods, intermediate inputs and/or raw materials from or selling his output to the technology supplier or any source designated by him, the prices of the articles shall be consonant with current international price levels;

viii) for a certain period of time the supplier shall guarantee to provide spare parts, components, and servicing of the technology without additional charges for maintaining this guarantee;

ix) all transfer of technology arrangements should include a provision by which if the licensor grants more favourable terms to a second licensee these terms will be automatically extended to the first licensee.

The recipient shall guarantee that:

i) the acquired technology will be used as specified in the contract;

ii) all legitimate payments as specified in the contract shall be made to the technology suppliers;

iii) the technical secrets as defined in the contract shall be honoured;

iv) the quality standards of the products specified in the contract will be reached and maintained where the contract includes the use of the supplier's trade mark, trade name, or similar identification of good will;

v) the socio-economic conditions and needs of the country of the recipient have been taken into account while entering into a technology transfer agreement. . . .

Measures according special treatment to Developing Countries

Transfers of technology to the developing countries shall include forms of preferential treatment designed to take account of the weaker position of their enterprises in the technological, financial or managerial field. Such measures shall include, *inter alia:*

i) phasing out of down payments, or including such payments as part of royalties on production, on a soft basis;

ii) scaling down of the charges for technology in proportion to the size of the recipient's market;

iii) untying of credits for the purchase, from the most competitive source, of capital goods, spare parts and intermediate components;

iv) rebates on imports of raw materials, equipment and components for licensed production;

v) development of local technological capability and research and development by technology suppliers with affiliated companies in developing countries;

vi) development of the research and development and technological capability of the recipient firm;

vii) adapting the technology to be transferred to make it appropriate to conditions and factor endowment of the recipient country;

viii) transferring to the recipient firm non-proprietary technology which the supplier may possess in the field of activity of the recipient;

ix) sub-licensing rights under special concessional terms. . . .

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[1] TD/B/AC.11/22 and Corr. 1. [2] See the Report of the Intergovernmental Group on Transfer of Technology, UN Trade and Development Board: TD/B/520 of 6 August 1974.

Dealing with the Transnationals

The Economic and Social Council at its 1974 summer session in Geneva approved in principle the establishment of an "appropriate permanent machinery" and an Information and Research Centre to assist the Council in dealing with the issues of multinational corporations. It was also decided to refer to multinational corporations as transnational corporations, a term which was considered to be more appropriate to their character and behaviour.

In its resolution, the Economic and Social Council requested the Secretary-General to set up the "nucleus" of a Centre, pending "further arrangements" regarding the modalities of its operation. The Centre will be financed through the regular budget of the United Nations "without prejudice to any voluntary contributions from Member States."

The Council decided to convene a Special Intersessional Committee to make recommendations concerning the specifics of the permanent machinery and its mandate, as well as on further arrangements concerning the Centre. The Committee, after meeting in New York from 11 to 15 November, 1974, will report to the next meeting of the Economic and Social Council (resumed 57th session) later that month where a final decision will be taken.

In mid-1973, in response to a resolution passed by the Economic and Social Council in July 1972, the UN's Department of Economic and Social Affairs published a study entitled "Multinational Corporations in World Development". *The 195-page document was intended to facilitate the work of a 'Group of Eminent Persons' appointed by the UN Secretary-General to study the role of multinational corporations and their impact on the process of development and on international relations. The Group held three plenary meetings and issued a Report in June 1974 for submission to the fifty-seventh session of ECOSOC.

During the first two plenary sessions, some fifty leading personalities from governments, business, trade unions, universities and special and public interest groups presented testimony and answered questions.

The first part of the Report of the Group of Eminent Persons deals in general terms with the impact of multinational corporations on the development process, seen as part of a world perspective. The remainder of the Report outlines some of the causes of the tensions which may arise between these corporations and nation states and suggests types of international action which might prove useful, including the setting up within the UN of a *Commission on Multinational Corporations* and an *Information and Research Centre.*

SUMMARY OF RECOMMENDATIONS

Improving the Impact on the Development Process

Developing countries should not rely solely or excessively on multinational corporations. International public aid should be increased, directed to the basic needs of the poorest people in developing countries—food, health, education, housing—as well as to the development of indigenous industries.

Host countries should be precise about the conditions under which multinational corporations should operate and the achievements expected. Centralized services or co-ordinating groups might be set up for negotiating and reviewing foreign investment. The United Nations should strengthen its capacity to assist host governments, upon request, in dealing with multinational corporations and in training their personnel for conducting such negotiations.

Provision should be made in the initial agreement for review upon request by either party of clauses of the agreement. Terms aimed at reducing the percentage of foreign ownership over a period of time should be agreed upon at the beginning to avoid later conflict.

Policies towards affiliates should preferably be similar to those applied to indigenous companies. Developing countries should intensify regional co-operation, particularly with regard to joint policies towards multinational corporations, and the United Nations should provide relevant information on existing regional groups and technical assistance.

Improving the Impact on International Relations

Multinational corporations influence the cultural mode of life and the political development of a country as well as its economic and technical progress. This has often had positive effects but, as has been well publicized, this power can be used for subversive ends. Host countries should both clearly define the limits of public activities of corporations and prescribe sanctions against infringements as well as regulate and provide for disclosure their contributions to special interest groups. The Economic and Social Council should call upon countries not to use multinational corporations as instruments for the attainment of foreign policy goals. If a multinational corporation participates in subversive activities, strict sanctions should be imposed and the host countries of the corporations is induced not to take steps which would make these sanctions ineffective. When a host country nationalizes assets of a multinational corporation, there should be fair and adequate compensation according to due process of law in the country concerned.

Home countries should not involve themselves in differences and disputes between multinational corporations and host countries.

Countries should ensure that multinational corporations do not violate sanctions imposed by the UN Security Council, for example, with regard to racist policies and suppression of human rights.

Formal consultative machinery should be established to deal with cases of conflicts of jurisdiction. An international agreement might ultimately be concluded to regulate the issue of extraterritoriality of jurisdiction.

Ownership and Jurisdiction

Host countries should define the sectors in which they would welcome foreign investment and the conditions to be imposed. Developing countries should retain control over the use of their natural resources. Where ownership is an important objective, the host country should consider establishing joint venture and reducing over time the share of foreign equity interests.

Products and Technology

Before a multinational corporation introduces a product, the host government should evaluate its suitability for meeting local needs. The centralized machinery proposed earlier for screening investment should also be used to evaluate the appropriateness of a given technology.

Multinational corporations should be required to contribute towards the product and process innovation most suited to national or regional needs and local affiliates should be permitted to sell their technology to other parts of the organization.

International organizations should try to revise the patent system and evolve a mechanism whereby the cost of technology provided to developing countries by multinational corporations can be reduced.

A World Patents (Technology) Bank might be established to which any public institution might donate for use in developing countries patents it owns or purchases for this purpose.

Host countries should explore alternatives to importing technology through direct foreign investment and international agencies should help them on request to determine the technology best suited to their needs.

Employment and Labour

Home and host countries should develop plans concerning employment objectives and inform multinational corporations of their policies.

The transfer of the production of labour-intensive and low-skill products should not be hampered by home governments. Home and host countries should provide for full compensation to workers displaced by production decisions of multinational corporations. For those countries unable to do so an international social fund might be set up with contributions from multinational corporations to supplement available resources. Maximum benefit from the entry of multinational corporations should accrue to lower income groups. The proposed Commission could study ways in which workers and their unions could participate at different levels in the decision-making process of the corporations. Countries should permit legitimate international movement of trade unionists and peaceful forms of concerted action. Data relevant for the purpose of collective bargaining should be made accessible.

Multinational corporations should be required to make public safeguards and working conditions for health and safety they observe in their own countries and to observe such measures as agreed with the host government. Home countries should discourage corporations from going into countries where workers' rights are not respected.

Consumer Protection

Affiliates of multinational corporations should be required to reveal any sales prohibitions or restrictions imposed elsewhere with respect to the protection of the health and safety of consumers. The host country can then decide whether warnings should be imposed on the sale and manufacture in that country. Home countries should publicize prohibitions and restrictions on products and consider whether their export should be restricted.

Competition and Market Structure

Multinational corporations should declare, upon entry, their intentions concerning purchasing and export policies and all possible restrictions.

Home and host governments, preferably through international agreement, should prohibit market allocation of exports by multinational corporations unless necessary to secure other benefits for the countries concerned.

Restrictive clauses and market allocation by multinational corporations should be eliminated within regional groups of countries.

The UN should undertake preparatory work on an international anti-trust agreement and, until this is in force, home countries should refrain from applying anti-trust policies affecting other governments. Only provisional unilateral action should be taken pending full consultation with these governments.

Home and host countries should enforce, wherever appropriate, the principle of "arm's length" pricing, i.e., prices as they would be charged by an independent seller to an independent buyer, and should draw up rules on pricing practices for tax purposes.

Provisions should be made in bilateral tax treaties for the exchange of information and consideration given to the feasibility of an international agreement on the rules concerning transfer pricing for taxation purposes.

Taxation

The work of the Group of Experts on Tax Treaties should be speeded up and bilateral treaties made as uniform as possible in order to pave the way for an international tax agreement. Developed countries should enter into such treaties with developing countries bearing in mind the importance of increasing the flow of capital and stengthening the revenues of the latter.

Information Disclosure and Evaluation

An expert group on international accounting standards should be convened, under the auspices of the proposed Commission on Multinational Corporations.

Governments should, as a rule, disclose the principal terms of agreements with multinational corporations and deposit this information with the proper information and research centre on multinational corporations. The Centre should prepare digests and summaries of all such information and devise procedures for the collection of information on the performance of multinational corporations in specific areas.

Commission on Multinational Corporations

A Commission on Multinational Corporations should be established under the Economic and Social Council. An information and research centre should also be set up within the UN to service the Commission. The Commission would act as a focal point within the UN system for consideration of issues relating to multinational corporations. In this capacity it would receive reports through ECOSOC from other UN bodies, provide a forum for the exchange of views among governments, organizations and special interest groups, including multinational corporations, and undertake work on arrangements or agreements pertaining to certain activities of these corporations. It would recommend a code of conduct for governments and multinational corporations for adoption by ECOSOC and explore the possibility of concluding a General Agreement on Multinational Corporations, with machinery to enforce it, in which countries would participate through international treaty.

In addition, the Commission would carry out studies, prepare reports, organize panels, collect, analyze and disseminate information. It would promote technical co-operation, including training and advisory services, with the aim of strengthening the capacity of host countries to deal with multinational corporations.

It is suggested that the Commission should have twenty-five members, serving in their individual capacity, nominated by the Secretary-General and approved by the Economic and Social Council for a renewable three-year term. It should hold one session a year, with special sessions or working groups as required, submit an annual report to ECOSOC and issue reports on specific subjects.

Information and Research Centre on Multinational Corporations

The Centre would be under the general guidance of the Commission and provide it with a range of administrative and substantive services. It would collect, analyze and disseminate information and undertake research.

*The UN Dag Hammerskjold Library has compiled a select bibliography of approximately two hundred titles on this subject.

Forecasting
The Technological Future

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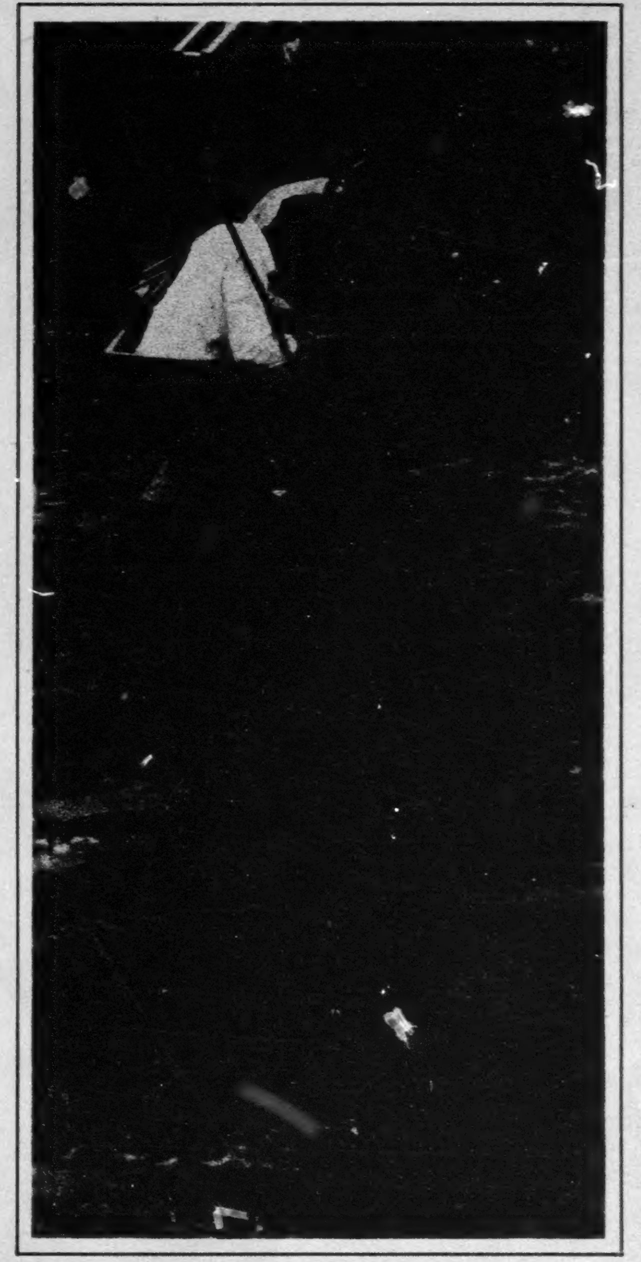
Technological change is an important determinant of the present time because of its profound effect on the economic, social and political environment of every nation and the international community as a whole.

In this situation, a rational approach to and solution of various outstanding technological problems call for long-range planning which should be based on an estimate of likely changes in the field of technology and other relevant areas. Generally a forecast is a statement about a future which the forecaster considers not only possible but probable. Time is a crucial parameter and therefore reference should be made either to a time point or a time period. Medium-term forecasts cover periods from five to ten or twelve years. Long-range forecasts focus on anything from ten to thirty years hence, or even more.

Technological forecasting emerged in the 1960's as a recognized managerial discipline indispensible for informed judgment and is now widely practiced in governmental and other institutions. The reason for this is obvious: no one can any longer afford to drift on to an unknown destination. The future, technological future in particular, should be a matter of choice made among available options before an actual decision is taken and a specific course of action recommended and pursued. Technological forecasting provides decision-makers with an indispensible tool for guiding, orienting and integrating science and technology within society and government. It is valuable for developing a conceptual framework and the main indicators for long-range planning, especially with regard to technological innovations, and has become a permanent function in all large and many medium-size industrial companies, the costs involved probably representing about one per cent of their total research and development expenditures which have a magnitude of billions of dollars. Transnational corporations, in their worldwide approach to business operations, rely heavily on technological forecasts to identify new opportunities and potentially profitable areas for research, development, production, distribution and management techniques.

For international organizations the knowledge of technological futures is extremely important. What new technology will emerge? What new areas of operation and interaction will come into the picture? How will current methods, policies and prices, including those in technology transfer, application of science to development, etc., be affected? The list of questions to which forecasts might provide some answers is inexhaustible.

Technological forecasting is itself dependent on technologies where advances, in their turn, allow advances in technological forecasting. For its implementation it requires sophisticated techniques and methodologies of which there are now more than one hundred. Forecasting may be general or its focus may be on objectives, relevant factors and criteria, interdependence between events, process dynamics, experts' judgment, overall evaluation, trend extrapolation.



There are two basic types of technological forecasting: exploratory and normative. Exploratory forecasts are based on an already available sum of knowledge and extrapolate from this knowledge into the future. Normative forecasts work the other way around. Future goals, objectives, tasks, needs and situations are assessed and then are projected backward through time into the present.

In dealing with forecasting, concern is usually expressed with regard to the accuracy of foreseeing technological breakthroughs which may have major profound impacts, like those of space, nuclear energy, computers, transistors and lasers. The likelihood of greater accuracy in forecasts has been greatly increased in the past decade with the development of many new methods, elements and techniques, for example, systems analysis, matrix thinking, input/output analysis, linear programming and others. The introduction of computers, especially digital computers and computer models, has increased the potentiality for more accurate forecasts. The improved techniques of data collection and information retrieval have also contributed to the increased accuracy of forecasts.

It is often said that one cannot predict technological breakthroughs that come with an unexpectedly rapid advance in scientific knowledge or discovery. But much depends on what is meant by a 'surprising advance'. Nowadays it is not an unpredicted explosion of knowledge in a specific field but rather a series of events and trends, a concentration of efforts in certain directions which could signal possible future happenings. Systematic identification and interpretation of these signals reduces the degree of uncertainty about technological and other consequences.

UNITAR has proposed a *Project on the Future* which could alert the international system about evolving problems, stimulate concern and action among scholarly institutions and encourage public discussion of the issues. Although many United Nations agencies are concerned with the future and make projections of their work and evaluation of relevant issues, there is no single focal point for forecasting trends which may have implications for the whole system. The Project on the Future might undertake specific topics in the way of "preventive forecasting", such as (a) bringing to the attention of the international community useful cases of technology assessment, that is, the social, cultural and economic consequences of technological options or developments; (b) analysis of long-term issues and trends; (c) forecasts in a variety of fields; (d) presentation of options and alternative scenarios for future development; (e) studies of the world system and how its elements interact, whether social, economic, technological, educational or cultural; (f) describing new methodological advances with examples of how they can be put to use; and (g) disseminating national and international experiences in trying to adapt to change and complexity.

Transformation of international relations is an objective process and may lead to the emergence of a new system of international relations in the future. Research on these trends, the investigation of new opportunities and possibilities for the future—these are important tasks for the United Nations.

Technological and other forecasting is not and probably never will be a precise scientific discipline because too many unknown and mutually dependent factors are involved. Many specialists consider it to be more art than science. But whatever the point of view, one can be certain that, despite all its imperfections, it will continue to be practiced with greater skill by more people and in more places because the need to know more about the future is real and urgent.

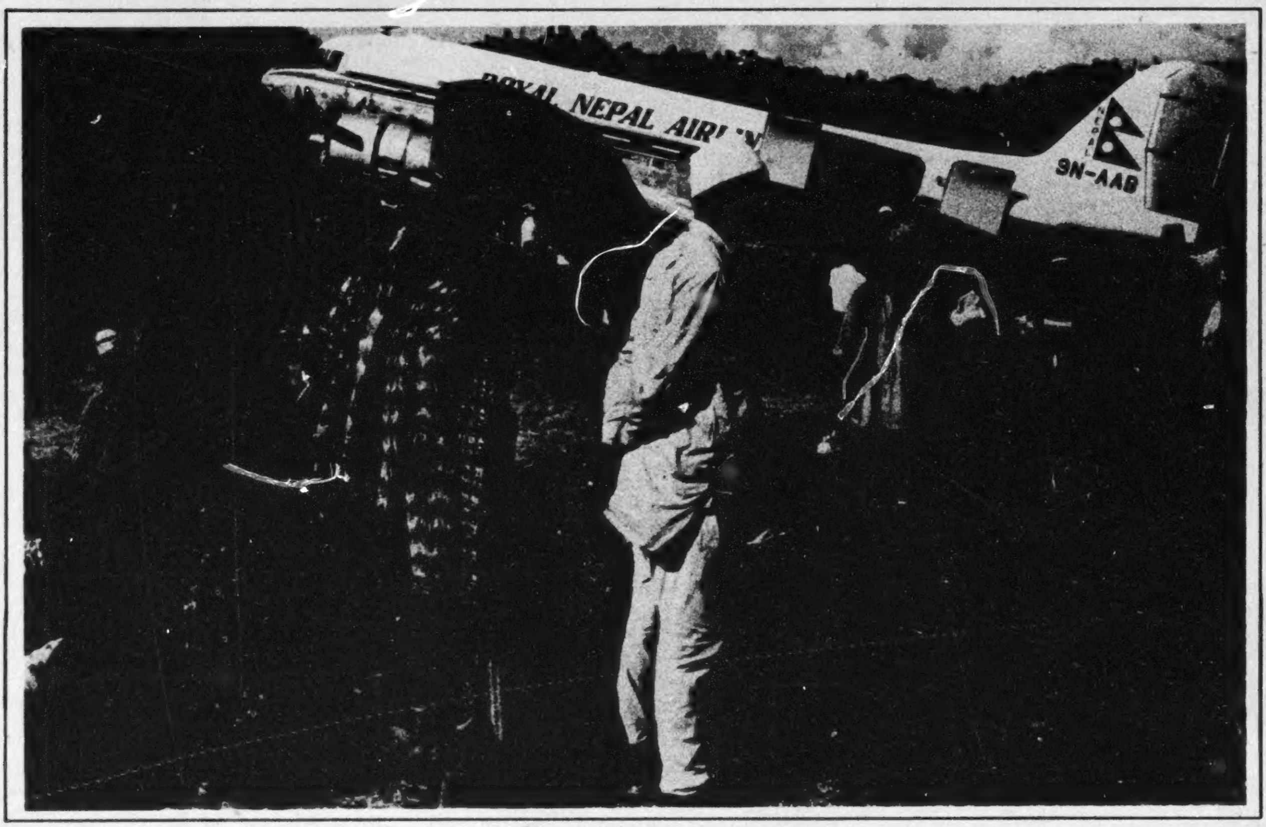


PHOTO A: Gathering data as part of Chile's expanding hydrometeorological system. PHOTO B: ICAO has assisted the Government of Nepal by providing civil aviation experts.

The Diplomat
in a
Technological World

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What types of scientific and technical information should be available to a diplomat at the United Nations? In what form should it come to him? Where should he look for it? And does he really need it? If not, what kind of service does he need to handle effectively the many policy issues directly related to science and technology?

Again and again, questions such as these come up at meetings and seminars, only to be buried once more under the pressures of everyday diplomatic business. One reason why the problem is not easily faced and answered is that there is no one solution equally applicable to all diplomats and all missions accredited to United Nations Headquarters. The relationship between technical expertise and diplomacy may be different in the various specialized agencies and other functional organizations.

One of the more prominent characteristics of the multilateral diplomatic process at the United Nations is the extreme diversity of conditions under which the national delegations carry on their work.[1] They differ widely in size, workloads, in diplomatic experience and skills. Some have less intensive communication links to their home governments than others. This sometimes gives them greater freedom to initiate and pursue specific diplomatic tasks and to respond to issues raised by others, but it also often leaves them without adequate backstopping, especially when it comes to technical information. At the other extreme are missions fully backed up by all the necessary expertise available to their home governments and with an internal division of labour which enables individual diplomats to build up their technical understanding of a specific policy issue.

Some diplomatic missions from developing countries face an impossibly difficult task. Inadequately equipped and with little support from home, they are expected to represent the interests of pre-industrial societies under the conditions set and in diplomatic arenas created by the post-industrial world[2]—a world in which scientific and technical knowledge is becoming the central moving force of society and the primary source of power and influence. They have to deal with problems generated by the scientific and technological progress of a few advanced countries. They have to react to international inequalities, risks and opportunities opened up by technological change and by new scientific knowledge. It is often up to them to alert their home governments to major policy issues of the future.[3]

Technical Information in Multilateral Diplomacy

The major ways in which a diplomat at the United Nations may effectively use scientific and technical information are fairly obvious.

1. Properly interpreted technical information becomes an important tool in the hands of a diplomat faced by agenda issues related to scientific and technological change—seabed mining, conservation of food resources, pollution, satellite communication, remote sensing, computer technologies are a few examples. There is also the tactical use of such information. If, for example, it can be effectively demonstrated that some technical data is lacking, this may help delay debates and decisions whose impact is not yet clearly understood and which may require reconsideration, or which are simply undesirable from a national point of view.[4]

2. Technical data and information can be used in the diplomatic process to generate new policy issues in the United Nations. Ambassador Pardo of Malta demonstrated how scientific and technical information can spark a diplomatic move and accelerate it to a take-off point when in 1967 he introduced the seabed issue in the First Committee of the General Assembly. The developing art of "diplomacy-by-data" may, of course, serve different purposes. It may provide a UN mission with a new sphere of influence and a better bargaining position. It may help prevent the domination by technologically strong nations of areas of transnational activity in which other countries seek a share. Similarly, the generation of new issues or agenda items by the diplomatic application of technical information may enhance a nation's position on specific regional or functional settings to which the newly raised issue is particularly related.

3. It is of especial importance for developing countries to cultivate a diplomatic sensitivity and alertness to matters with a transnational significance which becomes visible through the various UN interactions. This should be part of a feedback process. By a timely drawing of their home governments' attention to problems and opportunities emerging from scientific and technological change, the missions contribute to the formulation of national policies and gain a stronger foundation for their own diplomatic work.

These three basic functions of technical information in multilateral diplomacy amount to a potentially significant tool, especially in the hands of those whose other sources of political power and influence are meagre or non-existent. Since technology assessment is a complex social valuation of a technology and its impacts, and since it is still a very primitive art even in the most advanced countries, it is unavailable to most policy makers and diplomats. In multilateral diplomacy everybody is acting on a basis of considerable ignorance about the total impact of the technologies under discussion. Consequently, even those equipped with only a minimal techno-political insight may become competitive in the diplomatic market. Technical information, supplied at the right time and applied wisely, may well play the role of equalizer in the multilateral diplomatic process.

Processes and Problems

How is technical information for diplomatic purposes generated, interpreted, diffused and applied? What are the prevailing practices, deficiencies and needs?

Traditionally, the home governments of the diplomatic missions are the diplomat's primary sources of technical information. However, the phenomenal expansion of scientific knowledge and technological capabilities and the proliferation of transnational issues generated by that expansion result in a glaring inequality: a growing, rather than a decreasing, number of delegations must seek technical data and insight from foreign suppliers.[5] There are, of course, several sources of scientific counsel within the United Nations system, but the problem is not solved by multiplying the quantity of data. I share the feeling of many UN delegations that they are getting more technical information than they can ever absorb and that, in fact, the information overflow has a negative impact—less rather than more is gained in terms of useful knowledge if one must wade through mountains of reports in search of relevant items. The diplomat from a technologically advanced nation gets from his home government a steady supply of information which has been filtered through some process of policy evaluation and selection, not raw material from the notebook of a Nobel prize winner in chemistry. Experts do play a prominent role in the interpretative process, but they are at its beginning, rather than its end.

The major deficiency, then, from which several diplomatic missions suffer lies not in a lack of data, but in a lack of interpretative ability and the interpretation of technical data, whether as a simple and intuitive process or as a more rigorous, systematic and comprehensive process of technology assessment, as a national policy function. The impact of data, and technologies, can be effectively judged only if they are projected against a given set of social values or policy goals. Who can provide this service for a diplomat whose home government is not yet adequate to the task, bearing in mind that this problem may exist even where a nation already has a reasonably well developed mechanism for the formulation and application of science and technology policy. During rapid modernization, the capacity of these mechanisms is usually taxed by domestic issues of growth and the kind of transnational assessment of technologies needed for the proper conduct of diplomacy remains unavailable.

Bringing more scientists into the Secretariat is clearly not the answer. Nor is it possible to create, within the UN Secretariat, anything resembling a general technology assessment system giving equal service to all. Even when it is consciously and conscientiously balanced, such an appraisal of what must be a function of national policy cannot be fully apolitical and objective.

Diffusion and Application of Technical Information

How is technical information reaching the diplomat? Does he seek it as he feels the need for it? Does he know what he needs and what he can have? Is it brought to him in such a form as to let him pick what he can use?

In many instances, of course, it does not reach him at all. At a recent meeting at the United Nations a diplomat, while complaining that certain information pertaining to mineral deposits on the deep ocean floor had not been made freely available by those who possessed it, was resting his elbow on a UN publication which summarized from other earlier UN documents precisely that information. Thus the problem of diffusion of useful technical information mirrors a number of other problems: overflow of technical data; work overloads in those missions whose data and interpretation base is weakest; inadequate system of communication between diplomats and experts; lack of a systematically cultivated ability to receive and handle scientific and technical information.

The problem of how technical knowledge is applied in diplomacy is related to that of interpretation of data. As with any other diplomatic tool, the user must have a fairly accurate estimate of the responses he may generate in others. Even when he has a bloc of data properly and fully interpreted for his own policy ends, an understanding of how other delegations interpret the same data may be of considerable importance in selecting the forum, the time and the style to apply the information.

Proposals for UN Action

Many of the problems related to technical information in UN diplomacy are simply a symptom of the fundamental inequalities between the pre-industrial, industrial and post-industrial societies and therefore all remedies may at best be very superficial. The major ones must lie in providing *mechanisms which could serve as bridges between the sources of scientific data and the diplomat.* What is lacking in the UN diplomatic system is an effective, versatile, pluralistic information transfer process through which data can be distilled and softened to become pliable and more easily adapted to the various diplomatic options.[6]

1. *Diplomatic personnel* need a better understanding of the relationship between science and policy-making and a fuller recognition of how a diplomat can manipulate technical information. This certainly does not mean that diplomats should be trained to perform tasks in technology assessment. It does mean, however, that to use technical information effectively, especially when it is coming from sources outside his country, a diplomat needs to know how assessments are made, what choices the assessors face and how they reach their conclusions. Intensive workshops organized by UNITAR, in collaboration with other appropriate UN bodies, specialized agencies or national institutions, could provide starting points for the learning process.

2. Within the *UN Secretariat*, a distinct kind of specialist should be given the task of assembling and disseminating information in digestible form. A technical information specialist is seen here as a separate professional category. His basic education may have been in science, engineering, social sciences, philosophy, or any other discipline requiring skills in the systematic analysis of data, issues, or ideas, and an ability to distinguish between biased and objective judgments. Beyond this, however, the information specialist would have to have a sound understanding of the processes of science and technology policy-making and of technology assessment in particular, as well as a familiarity with and an access to the sources of scientific and technical information. His chief function would be to make available on request to individual missions such evaluated technical information as they may require, to advise them as to the possible bias of that information, and to suggest to them other related information that should be considered in a given context. Individuals capable of providing such service are already to be found in the UN Secretariat as well as outside. Some of them do act partly as information specialists through their contacts with missions, but mostly in a very sporadic and casual manner since their primary assignments usually lie elsewhere. This is not the place to discuss in detail whether and how this service can be fitted into the Secretariat and how it can be made operational. At present, the relevant bodies within the Secretariat are almost never used by UN diplomats as a source to which they go for evaluated technical information.

3. There is room for more systematic links to ensure *communication between diplomatic missions and outside institutions* such as international and other professional societies, universities and similar organizations with developed capabilities in the study, formulation or application of science policy.[7] In several areas, UNITAR is beginning to fulfill the function of catalyst and intermediary in forging such links. Much remains to be done, however, to expand the network so that technical information may be more effectively transferred.

4. The development of *"adversary" briefings*[8] on specific technological issues with transnational dimensions may help mitigate the apprehension that information received by the diplomat from foreign sources is not only biased but that the bias may be invisibly built in. Such briefings, with opposing teams of experts from various disciplines and of varied ideological persuasions, could best be organized outside the formal UN framework through UNITAR and other appropriate bodies.

5. The most difficult, yet in the long run probably the most important step, would be the development, within or close to the United Nations, of some technology-oriented *"early warning system"* especially geared for those diplomatic missions whose governments have not as yet developed such capability. This system could also be implemented through periodic workshops and briefings and would consist of assessments of future technologies likely to have an impact on international interests and relationships.

There are other mechanisms which could facilitate the information transfer process in technical matters of concern to UN diplomacy (and, ultimately, to all Member States) but no single method can effectively provide an adequate substitute for evaluated technical information. Only a diversity of sources, a rich mix of formal, informal, in-house and outside mechanisms, can achieve a modicum of balance among biased interpretations, enabling the diplomat to suggest viable options and his government to have a solid background for policy-making.

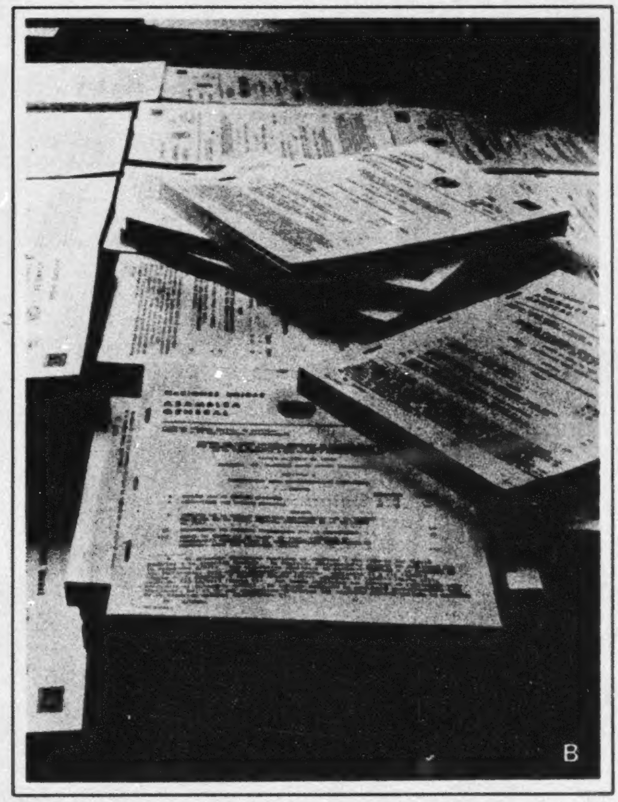

PHOTO A: UNITAR training programme in Diplomacy (photo: Y. Ripplinger) B: (photo: Y. Ripplinger)

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[1] John G. Hadwen and John Kaufmann reflect much of that diversity in *How United Nations Decisions Are Made* (New York: Oceana, 1962). [2] There is considerable amount of literature dealing with the various related concepts—the "post-industrial society" or the "knowledge society" or the "scientific society." A brief and lucid presentation of one of these concepts is Daniel Bell's "The Measurement of Knowledge and Technology" in Eleanor B. Sheldon and Wilbert E. Moore, eds., *Indicators of Social Change: Concepts and Measurements* (New York: Russell Sage Foundation, 1968), pp. 145-246. [3] As Oscar Schachter stressed in a context somewhat different but fully relevant, "what is crucial here is the capability to assess the future import of scientific and technological experimentation . . . ." Oscar Schachter, "Scientific Advances and International Law Making," *California Law Review*, v. 55, No..2 (May 1967), p. 427. [4] The seabed debate, especially in its early 1967-68 phase, was rich in examples of such "diplomacy by data." For more detailed observations of that process see Z.J. Slouka, "United Nations and the Deep Ocean: From Data to Norms," *Syracuse Journal of International Law and Commerce*, v. 1, no. 1 (October 1972). [5] Michael J. Brenner, "The Science Advisory Function: The Case of International Marine Environment Policy" (monograph, private print, 1973), p. 27. [6] Although concerned with the U.S. Congress, a political forum vastly different from the United Nations, Richard A. Carpenter offers many observations on the information transfer process fully relevant in the present context. See his "Technology Assessment and the Congress," in Raphael G. Kasper, ed., *Technology Assessment: Understanding the Social Consequences of Technological Applications* (New York: Praeger, 1972). [7] In July 1974 Sierra Club International and the Audubon Society jointly offered three seminars dealing with seabed oil, hard minerals and living resources for delegations at the Law of the Sea Conference in Caracas. This undertaking, although connected with a specialized meeting, may provide one model for briefings on various timely subjects at United Nations Headquarters. [8] For a discussion of the adversary process on a national level see Harold P. Green, "The Adversary Process in Technology Assessment," in *Technology and Society*, v. 5, no. 4 (March 1970).

Energy:

An International Approach

The rising price of oil, growing uneasiness about depletion of fossil fuels, shortages of fertilizer and therefore of food, pressure from environmentalists about pollution from both conventional energy sources and nuclear power plants . . . all these serve to focus attention upon energy problems, especially as they affect developing countries.

In an attempt to disseminate some prevalent ideas about this topic as it concerns the United Nations, and to open up the subject for wider debate, we present some conclusions which emerged from two recent conferences, together with comments on these conclusions from the UN Centre for Natural Resources, Energy, and Transport.

These conferences considered some of the major problem areas related to world energy, what might be required in the way of further research and study, how these matters might be dealt with at the international level, all with special emphasis on the needs of developing countries.

The first meeting was the third UNITAR seminar for senior UN officials, which met at Schloss Hernstein, Austria from 19 to 21 June, 1974. There were also participants from outside the UN system, from Nigeria, Zaire, Iran and the United Kingdom. The second was the twentieth Pugwash* symposium, which took place from 4 to 8 July 1974 at Arc-et-Senans, France, to discuss "the strengthening and expansion of an existing institution already dealing with international energy problems or the broadening of some other international group to include such problems or the formation of an entirely new International Energy Institute."

There is no consensus in the views we put forward. Indeed in some places there are strong differences of opinion, natural in such a controversial area. It is hoped that the airing of such divergent viewpoints may lead to further constructive thinking and action, inside and outside the UN system.

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*For further information about the Pugwash conferences, see page 26

The main areas for discussion at both meetings can be broken down as follows:

Functions and Problems Requiring Study

Many of these questions overlapped at the two conferences, but the approaches were different, reflecting the fact that one set of participants consisted mostly of UN officials and the other mostly of independent scientists.

The ***UNITAR seminar*** saw the priorities mostly in terms of functions.

Information: collecting and processing relevant information by setting up a global data bank on energy and assisting individual countries to set up a data link; creating a forum where producers and consumers of oil can exchange ideas on problems of mutual concern, including long-term questions of demand and supply and prices, to try to ensure a more stable and predictable situation.

Exploration: assistance in surveying and exploring various energy resources, including oil, gas, coal, oil shale, tar sands, hydro-electric and geothermal energy, etc.; expanding energy supplies in rural areas by using fuel wood, agricultural and municipal waste and other available renewable sources; finding new methods of financing exploration and development of energy supplies in oil-importing developing countries.

Technical assistance, particularly to developing countries: provision of various technical advisory services in the field of energy; establishment of an energy efficiency service to assist countries in reducing energy wastage in all branches of the economy; aid in commercial negotiations ranging from exploration agreements to the acquisition of proprietary technologies; setting up international agreements on standards and definitions as they relate to energy resources as well as safety and environmental standards; planning and co-ordinating the application of scientific research on an international scale in order to avoid duplication and take full account of the needs of developing countries.

The ***Pugwash symposium*** concentrated more on pinpointing problems requiring urgent investigation:

Research and Development: new sources of primary energy (solar, geothermal, fusion, etc.), of secondary energy (coal gasification, hydrogen, etc.) and resource assessment; economic problems of energy, particularly scarcities in developing countries; sectoral inputs of energy and its role in capital formation and GNP.

Implications of the energy crisis:

environmental: physical limits of energy growth, nuclear wastes, pollution of biosphere including thermal and chemical pollution and variations in pollution and safety standards, perception and acceptability by the general public of risks and adverse consequences;

financial: balance of payments problems, development funding, taxation structures, capital expenses and operating costs;

social: regional dislocation; poverty; living standards; choices open to the general public.

National and International Policies: political and institutional aspects, e.g. monitoring the work of national and international bodies; self-reliance vs. external dependence; co-operation vs. confrontation; harmonization, co-ordination and synthesis; control and regulatory mechanisms; policy formulation and methodology, e.g. criteria of choice, including cost-benefit ratios, alternative scenarios, time scales, models and prediction, recognition and correction of errors; structure of energy industry, e.g. distribution and relationship to demand; relationship to other sectors such as food, raw materials, housing, life-style; wastage and conservation; price flexibility.

The ***Centre for Natural Resources, Energy and Transport*** shares the views expressed at the UNITAR seminar concerning priorities in terms of functions.

These priorities coincide with the structuring of the Centre's programme in the field of energy as well as mineral resources, particularly concerning the collecting and processing of relevant information. Steps are already being taken in order to strengthen the ability of the Centre to serve as an information unit, much along the lines of the global data bank mentioned in the seminar's recommendations.

The Centre's activities in this field of information stem from Economic and Social Council resolution 1761 B (LIV) in which, following the recommendations of the Committee on Natural Resources, the Council, *inter alia,* requested the Secretary-General "to take the necessary measures, within the budgetary limitations, to improve and strengthen the existing United Nations services for the analysis, evaluation and dissemination of world-wide data on natural resources." It should be noted, however, that present budgetary constraints limit the scope and magnitude of the Centre's operations well below the ultimate goal of a global data bank, though the essential basis already exists.

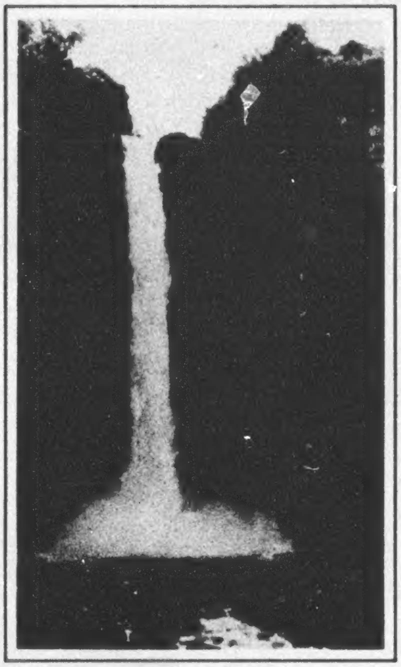
Other priorities indicated in the recommendations are reflected in the technical co-operation programmes for which the Centre is substantively responsible and which could benefit from further strengthening.

Institutional Arrangements

In this area too, the attitudes were different. The participants at the ***UNITAR seminar*** were thinking in terms of UN structures operating in the field of energy, while those at the Pugwash symposium were mostly thinking in terms of a new body outside the UN system. It is not at all clear what is really needed in the way of new international institutions to deal with energy but there does seem to be a drive towards having a more concentrated approach than has been evident hitherto.

Some of the observations are quite outspoken, all to the good if they serve to clarify the situation and eliminate some misconceptions.

Some participants at the UNITAR seminar recommended that the UN establish a technical service to carry out work related to energy exploration and development, including data collection and assessment and technical assistance. It was suggested that this service be under the general policy authority of the Economic and Social Council and that the appropriate organizational form might be modelled on the UN Environment Programme.



Those present from the specialized organs of the UN system stated that, in their opinion, the existing organizational machinery could carry out all needed functions should governments so decide. If this were the case there would of course have to be an expansion, intensification and co-ordination of activities which were at present dispersed throughout various branches of the Organization.

It was proposed also that there should be a UN mechanism which could provide a forum for exchange of views between producing and importing countries. Regular meetings could provide useful data, and such a continuing producer-consumer dialogue might gradually evolve into a long-term effort to bring about stability in policies and improvement in marketing and distribution.

Participants at the ***Pugwash symposium*** made the following points. Because of certain deficiencies:

- lack of a truly independent, flexible and objective institute,
- lack of detailed information for those who require it for assessment and decision, especially in developing countries,
- neglect of global problems, e.g. thermal pollution,
- lack of training/educational facilities and programmes,
- restrictive terms of reference of existing bodies,
- failure to disseminate adequately to the general public information of critical importance,
- lack of examination of alternative energy futures, and the lifestyles consequent upon usage of energy,
- lack of integrated policy-making,
- lack of systematic and comprehensive technology assessment,

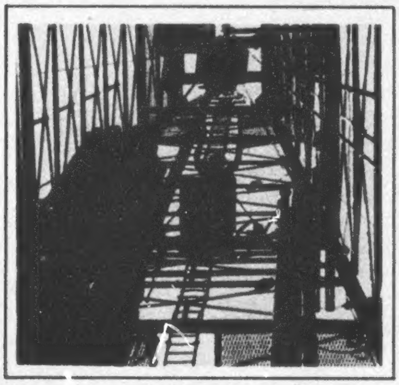
a new type of body is needed which is independent, informed, inter-disciplinary and flexible. Its function should be to question the basic assumptions underlying energy policy-making and to stimulate a more comprehensive and rational approach to the serious problems which surround the increase of energy supplies. It should be concerned with the collection, evaluation and, most importantly, with the effective dissemination of basic information to the general public as well as to specialists. It should also undertake the independent assessment of existing programmes and the initiation of long-range studies commensurate with the scale and complexity of global energy development, as well as the stimulation of other bodies to carry out such assessment. In particular, it should emphasize alternative strategies and, wherever relevant, underline the extent of divergence of opinion amongst scientists and amongst the general public.

While the ***Centre for Natural Resources, Energy and Transport*** agrees with the urgent need for strengthening the work of the United Nations system of organizations in the field of energy, it also shares the views of other organizations that the present institutional structure is adequate for absorbing an increased level of activities.

It also agrees on the adequacy of the present machinery for co-ordination both at the substantive and at the administrative levels. It is felt that budgetary rather than institutional limitations constitute the main stumbling block in expanding the scope and significance of the UN system's activities in the field of energy.

The establishment of a new energy structure would add to the administrative cost of executing programmes without adding significantly to the quality or coverage of activities. Because of financial limitations, it would appear that the financial strengthening of the present structure would be more likely to achieve the intended results.

For similar reasons, it is suggested that the ECOSOC's Committee on Natural Resources can act, and to some extent is already acting, as the governing body suggested in the recommendations stemming from the UNITAR seminar. If need be, special sessions or long regular sessions of the Committee could be called for this purpose.



Financial Arrangements

At the ***UNITAR seminar*** it was stressed that it was not easy for developing countries to finance exploration of energy sources and, when the exploration succeeds, to finance the necessary production and transportation. A Revolving Fund for Mineral Exploration had recently been established by the UN Development Programme, but it would meet this need only to a limited degree. It was unlikely to be large and would have to finance the exploration of minerals other than those related to energy. Moreover, the fund was not available for development. Short-term financing to ease balance of payments problems is already being dealt with by the creation of the new International Monetary Fund "facility" and the Special Fund established at the General Assembly's sixth special session. Larger long-term problems are another matter.

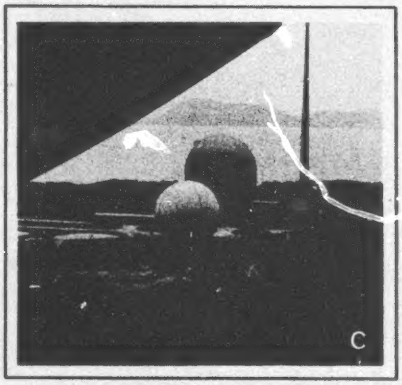
If a new mechanism were to be created, the size of its budget and its sources of finance would depend very much on the functions to be assumed and the institutional form taken. If it were limited to research, information and technical assistance activities, the expenditure would be mainly staff salaries, which could be carried out through additional appropriations from the general United Nations budget. If, however, it had responsibility for financing explorations and similar projects, then it would require finance on a quite different scale, although staff salaries could still be carried by the regular UN budget. One possibility is a bond issue, the proceeds to be paid into a fund out of which loans would be made to oil-importing developing countries. There are many conceivable sources of finance here. Bonds could be sold to private investors, banks, insurance companies or governments. This might be a way of absorbing funds of petroleum exporters, although in this case the lending governments might expect two safeguards: participation in the governing council and a guarantee that the bond issue would be properly serviced. Interest rates and the form of guarantee raise complex issues which would need further discussion. Participants from the OPEC confirmed that if those countries were to contribute substantially to energy exploration and development, they would undoubtedly insist on an important policy-making role, especially if there were any question of a new body being set up.

Another possibility for consideration is a tax on energy consumption. It could be done in various ways. It could be a tax at the retail stage (or part of the tax already collected by governments) or it could be arranged that a slice of the profits might be taken at the processing or distribution stage, in which case it would in effect divert funds for exploration from private to international control. Many arguments are expressed *pro* and *con* each of these forms of international taxation, including whether the tax should be applied only to oil or also to other sources of energy.

The ***Pugwash symposium*** suggested that petroleum-producing countries might provide significant aid to other developing countries either through bilateral or international channels. The funds involved would do a great deal to ameliorate the adverse effects of the recent energy price rises on developing states and, if used imaginatively, might provide the basis for a promising new effort on development and energy problems.

Funds from oil-producing and developed countries could be used to create an international institution dedicated to financing the costs of developing nations' energy needs. The institution could be governed by a tripartite board equally representing the principal oil exporters, other developing countries and the developed nations. The purpose and spirit of this arrangement would be to insure that no one group dominated the organization. Equally important to the governing mechanisms of the institution would be its essential philosophical and strategic priority, namely, that the institution would operate on the principle of "indigenous choice" by developing countries of their energy systems. The organization would provide money to a developing country, but the criteria for choice of and planning for energy systems would be formulated at the national level.

The ***Centre for Natural Resources, Energy and Transport*** shares the seminar's concern with the need to strengthen the availability of financial resources for such activities as the collection, analysis and dissemination of information in the field of energy, as well as for technical co-operation activities.



Although a new fund for the exploration of energy resources would indeed make an important contribution by quickening the pace of energy resources exploration, the desirability of establishing such a fund should be looked at in the light of the possibility of channeling the additional financial resources through the United Nations Development Programme and of the recently established United Nations Revolving Fund for Natural Resources Exploration.

* * *

How can the international community best serve the world's needs in energy resources? The debate is wide open, to be continued for some time to come.

PHOTO A: ***Falls near power plant, Philippines*** ***B:*** ***Centre for Petroleum Development, Bolivia*** ***C:*** ***Bhabha atomic research centre, India***

WORLD ENERGY RESOURCES

Each of the energy sources listed in the table below can be used directly or indirectly for the generation of electricity, and most of them can be used for the production of heat in industry or agriculture as well as in the home. However, the cost structure and location – proximity to consumption centres – often determine the economic attractiveness of the resource. Two further considerations are, first, the environmental impact, which varies in that fuel resources tend to create more environmental problems than non-fuel resources and, secondly, the fact that most fuels represent non-renewable resources while the non-fuel resources are, within certain limitations, renewable.

Whether or not a resource will be developed usually depends upon economic factors. All energy resources differ, each from the others, quantitatively, qualitatively and, in the case of non-renewable sources, in availability . Some which are usually regarded as economically advantageous, such as oil, may not be so attractive in certain circumstances. There are considerable variations in cost and only close study can determine the economic benefits or draw-backs of a given resource in a given area. But energy is a vital requirement of modern societies and, no matter what the price, oil remains essential for air transport, for the present type of cars, for the petrochemical industry as it is at the moment and for certain other uses.

Parts of the globe are still unexplored, and knowledge of its energy potential is fragmentary . Moreover, as energy price levels creep upwards and technology improves, sources previously explored and classified as uneconomical may be reassessed. This applies especially to coal, hydropower and oil from shale and from secondary and tertiary recovery in oil fields.

There will undoubtedly be improvements in the current conventional and non-conventional methods of energy conversion which will probably further extend the time period before some resources are depleted. This will allow time for building up renewable resources and learning how better to conserve them, thus extending the possibilities of continuous energy supplies.

FUEL RESOURCES

SOURCE	ADVANTAGES	DISADVANTAGES
Petroleum Essentially a complex mixture of hydrocarbons with small amounts of other substances; recovered from onshore and offshore fields, tar sands and oil shale; also found in deep sea.	— Abundant and accessible (world production in 1970 represented only 3.5% of proven world reserves). — Deposits are widespread in sedimentary areas. — Highly versatile: high grade fuel is obtained by refining and processing; petroleum and its by-products are used for transportation, heating, lighting, cooling, lubricating, medical products, animal protein, fertilizer, etc.	— Non-renewable. — Requires considerable capital investment. — Causes atmospheric pollution through combustion. — Cost of production from tar sands and oil shale is higher than from conventional sources. — Offshore exploration and drilling is more expensive than on land. — Extracting oil from deep-sea areas beyond continental shelf involves technological and legal problems. — There are growing difficulties in maintaining an equilibrium between supply and demand.
Natural gas A combustible gaseous mixture that when in gas fields ("non-associated gas") contains largely methane and, in wet state, with petroleum ("associated gas") contains other hydrocarbons. Found in natural gas fields, in coal mines, in geopressure zones; can be obtained from bio-digesters and as a by-product of coke-making process.	— Relatively cheap and abundant. — Relatively clean, virtually sulphur-free (except for sour gas). — Versatile: used as a raw material for petrochemicals.	— Non-renewable except when produced from organic waste or algae. — Expensive to transport when liquified. — Risky to handle because of vapour clouds and danger of fire. — Causes some atmospheric pollution when used in power plants. — Is not yet used in areas where no large markets are available to justify high cost of transportation.
Coal A solid combustible mineral substance containing essentially carbon, with small amounts of hydrogen, oxygen, nitrogen, sulphur and other constituents. Can be classified as anthracite, bituminous, subbituminous and lignite.	— Very abundant (world production of coal and lignite in 1970 was 35.4% of total energy production). — Deposits are widespread in sedimentary areas. — High grade coal contains 70-80% of the energy per unit weight of oil. Some kinds of coal are low in sulphur. — Lignite can be used to produce a high grade smokeless fuel through the briquetting process.	— Non-renewable — Deep mining can be dangerous, expensive and hazardous to health. — Surface stripping damages the land and creates problems of soil erosion and unproductive land unless remedial work is undertaken, which may be expensive. — Causes atmospheric pollution through combustion releasing carbon dioxide, sulphur dioxide and fly ash. — More expensive to transport than oil.

Peat Compressed and carbonized vegetation found in the form of bogs. Used as fuel when dried or briquetted. Gas can be obtained from by-products.	— Moderately widespread in many parts of the world. — Can be used locally for domestic purposes and for electricity generation. — Low cost if no transportation is involved.	— Can be more costly than coal to produce on a commercial basis. — Non-renewable.
Nuclear fission Splitting atoms of heavy elements such as uranium and thorium results in the release of enormous quantities of energy. Plutonium is produced in nuclear reactors. Uranium is found in rocks and seawater, also as a by-product of minerals, such as gold, phosphate, oil-shale.	— Uranium fairly widespread in nature. — Powerful energy source: uranium releases 20,000 times as much heat as from the equivalent weight of coal. — Could provide unlimited energy resources through nuclear breeder reactors. — Power plants can generate electricity. — Heat could possibly be used for desalination of water.	— Installation of nuclear plants needs much capital and suitable sites are difficult to find. — All existing types of reactors consume more fissionable material than they produce. — Pollution from : - thermal waste (heated water dumped into river or sea) threatens aquatic life; - radioactive waste is hazardous to health; - plutonium used in breeder reactors is a dangerous poison. — Storage facilities of radioactive substances have a short life in relation to the life of the radioactive materials. — Material can be stolen or otherwise diverted for use in nuclear weapons. — Control of use of atomic energy raises complex political issues.
Waste products Agricultural and municipal wastes provide steam when burned; animal waste can be dried and used directly as a fuel or converted to methane by fermentation or converted to oil or gas by methods of decomposition.	— Easily obtained and renewable. — Can be used for the generation of electricity. — Can be reprocessed to produce cattle feed. — Solves problems of waste disposal and of related environmental pollution.	— Organic municipal waste produces low-grade fuel. — Large-scale collection of agricultural organic waste could be costly. — Technical problems are still to be solved, e.g., how to handle non-organic solids. — Can only complement other sources of energy.
Wood Firewood is a traditional source of energy.	— Provides heat for domestic purposes. — Methanol can be produced from wood. — Renewable. — Less polluting than other fuels.	— Provides less heat per unit of weight than other fuels such as coal and oil. — Inefficient conversion causes polluting smoke. — Other industrial uses - construction and paper production - may yield a higher return than its use for energy. — Forests are far from industrial centres.

NON-FUEL RESOURCES

Hydropower * Water power used to supply energy.	— Clean method of electricity production. — Can be a cheap source of electricity.	— May involve high initial construction cost. — Growing shortage of natural sites. — Damming the water may cause changes in the environment, backwater sedimentation and rapid silting.

SOURCE	ADVANTAGES	DISADVANTAGES
Geo-thermal Energy supplied from the heat of the earth's interior, hot springs, hot rocks.	— Abundant. — Can generate electricity and provide heat for domestic, agricultural and industrial purposes. — Can be used to desalinate water. — Can generate electricity economically in relatively small power units. — Can provide base load of 8000 hrs/year not subject to seasonal variations. — Where a requirement for district heating or greenhouse heating exists, geothermal heat can be produced at very low cost.	— Found principally in areas of tectonic activity. — Environmental pollution possible: - release of sulphur components; - highly mineralized hot waters containing toxic materials may have to be reinjected into the field; - may create thermal pollution when used for electricity generation. — Hot water and steam must be used close to source therefore cannot be traded inernationally. — Technology for obtaining energy from geo-pressure zones and hot rocks not yet developed.
Tidal Generating power from the flow of tides, a special case of hydroelectric development.	— Non-polluting. — Renewable.	— Possible only in areas where difference in tide levels is high enough to generate electricity. — Output is intermittent and depends on tide cycles. — Installations required are complicated and costly.
Wind * Power from force of wind.	— Traditionally used in many rural areas, e.g., pumping water, turning millstones. — Non-polluting. — Small wind generators can supply electric energy in isolated regions.	— Variation in energy output according to duration and force of wind. — Storage of electricity when wind velocity changes is expensive. — For large-scale production suitable sites with adequate wind power are hard to find. — Can only be complementary to other sources of energy.
Solar energy Sunlight affects rains, winds and ocean currents; provides energy for plant and animal life cycles through photo-synthesis.	— Direct use of heat for water and space heating, cooking, drying crops, desalination of water, evaporation to produce salt. — Renewable, diffuse and inexhaustible. — Non-polluting and safe. — Considerable potential for space cooling; water pumping; conversion of sunlight to electricity through solar cells and use of photosensitive materials such as silicon; possible use for extraction of hydrogen from water.	— Limited hours of sunlight and variation of solar intensity. — Solar collectors provide low-grade heat on a small scale. — Technical difficulties in using on a large scale: - Conversion and collection techniques must be improved; - Back-up plant is required to ensure continuity of supply from such an intermittent source. — Power systems entail high initial costs. — At present, can only supplement other sources of energy.

*Hydropower and wind are functions of solar energy.

POSSIBLE FUTURE RESOURCES

Solar energy from outer space Solar cells in space satellites to generate electricity and send it by microwaves back to receiving stations on earth.	— Sunlight is inexhaustible. — Needs no storage system.	— System likely to be extremely costly. — Could produce thermal pollution if used on a large scale. — Legal status of use of energy will have to be settled.

Hydrogen Simplest and lightest of elements, occurs in a free state only sparsely on earth but abundantly in the sun, many stars and nebulae. Can be produced from natural gas or coal, electrolysis of water; production by means of solar or nuclear power is a possibility.	— Almost non-polluting. — Could be used as fuel for home heating, cooling or transportation. — Could be used as energy carrier to distribute electricity over long distances or in feeding fuel cells to generate electricity. — Is used at present as fuel for rocket propulsion where cost is not prime consideration. — Used as chemical feedstock and in industry.	-- Production of hydrogen requires more energy than is recovered by its combustion. — Production and liquefaction very expensive. — Means of storage in small space needs to be developed (gaseous hydrogen is bulky). — Lack of safety : because of its high diffusiveness, any leak would cause an explosion once it were mixed with air. — Production for energy extremely expensive.
Nuclear fusion The union of atomic nuclei of light chemical elements to form nuclei of heavier elements resulting in the release of enormous quantities of energy. Tritium and deuterium (isotopes of hydrogen) are the probable fuels to be used in a fusion reactor. Deuterium and tritium present in seawater.	— Virtually inexhaustible. — Likely to be safe. — Pollution-free, no release of carbon dioxide. — Might breed its own fuel and burn it immediately.	— Fusion reactors are not yet scientifically feasible.
Sea-thermal * Difference in temperature between warm water at surface and water 3000 feet or more beneath the ocean surface can produce electricity by means of a heat engine operating across the temperature differential.	— Renewable. — Non-polluting. — Sea-thermal systems could absorb thermal pollution on coastlines. — Benefits from simultaneous production of electricity and desalineated water. — Fish farming would be possible with nutritious sea-water pumped from depths.	— Energy produced is expensive. — An early attempt to construct a pilot power station was not successful. Economic and technical problems remain to be solved.
Waves* Rolling motion has energy for potential use.	— Non-polluting. — Safe.	— Intermittent except where constant waves prevail. — Pilot plants are being constructed. — Adequate wave power distributed unevenly along the coastline of the world. — Probably not for large-scale supply of energy.
Ocean currents* Speed and motion of current is source of power generation.	— Non-polluting — Safe	— Not concentrated. — Systems for electricity generation similar to those developed for tidal power are needed. — Not for large-scale supply of energy.
Algae, including kelp Methane is produced when algae are digested by bacteria.	— Easy to grow and harvest on land, in freshwater ponds and in ocean areas. — Methane could be used to feed fuel cells and produce electricity.	— Present kelp yield from the sea is not large in relation to world requirements.
Volcanoes	—Contain large quantities of energy.	— Technology to make use of volcanic energy not yet available. — Volcanic heat less than that produced by hot springs.

*Waves, currents and sea-thermal are functions of solar energy.

Towards a New International Economic Order

> *"We, the Members of the United Nations, . . . solemnly proclaim our united determination to work urgently for the establishment of a new international economic order based on equity, sovereign equality, interdependence, common interest and co-operation among all States, irrespective of their economic and social systems, which shall correct inequalities and redress existing injustices, make it possible to eliminate the widening gap between the developed and developing countries and ensure steadily accelerating economic and social development in peace and justice for present and future generations."*

The United Nations has often been accused of indulging in high-flown oratory while failing to give due recognition to world realities. The words quoted above, which appear in the Declaration on the Establishment of a New International Economic Order adopted by the General Assembly without a vote on 1 May 1974, certainly express an idealism which can be found in other UN documents, but the Declaration is backed up by a Programme of Action which takes cognizance of harsh facts and sets out in specific details how to deal with them. This blueprint for action includes a Special Programme designed to help the developing countries most seriously affected by the world economic crisis. The adoption of the Declaration and the Programme of Action, which mark a turning point in the economic relations among nations, was the culmination of the sixth special session of the General Assembly, held at United Nations Headquarters in New York from 9 April to 2 May 1974, under the presidency of Ambassador Leopoldo Benites of Ecuador.

The Programme of Action

The Programme of Action on the Establishment of a New International Economic Order is based on the principles laid down in the Declaration, including:

> Full and effective participation on the basis of equality of all countries in the solving of world economic problems in the common interest of all countries;
>
> The right of every country to adopt the economic and social system that it deems the most appropriate for its own development;
>
> Full permanent sovereignty of every State over its natural resources and all economic activities;
>
> Regulation and supervision of the activities of transnational corporations;
>
> Establishment of a just and equitable relationship between the prices of raw materials, primary commodities, manufactured and semi-manufactured goods exported by developing countries and the prices of raw materials, primary commodities, manufactures, capital goods and equipment imported by them;
>
> Access of developing countries to the achievements of modern science and technology, promotion of the transfer of technology and creation of indigenous technology for the benefit of the developing countries;
>
> Strengthening, through individual and collective actions, of mutual economic, trade, financial and technical co-operation among the developing countries.

With a view to ensuring the application of the principles set out in the Declaration, the Programme of Action calls for

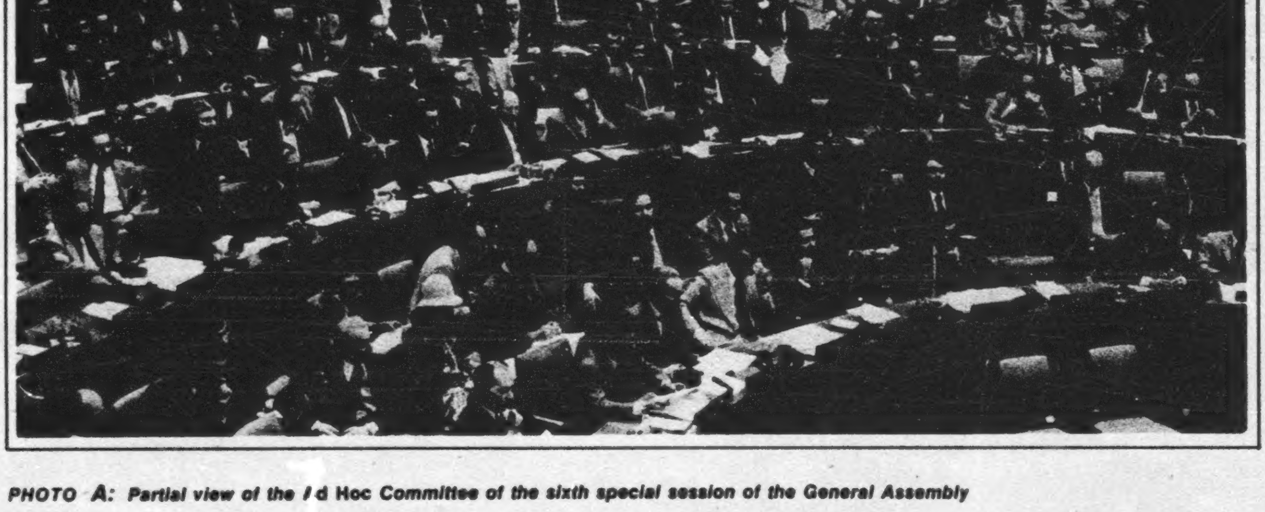


PHOTO A: Partial view of the Ad Hoc Committee of the sixth special session of the General Assembly specific efforts in connexion with a number of key issues. The salient features of the Programme of Action are summarized below:

Fundamental problems of raw materials and primary commodities as related to trade and development

Raw materials

Measures should be taken with a view to ensuring that the exploitation of natural resources, particularly those of developing countries, serve the national interest of the countries concerned, promote collective self-reliance among them and strengthen mutually beneficial international economic cooperation. Efforts should be to facilitate the functioning and to further the aims of producers' associations, to reverse the continued trend of stagnation or decline in the real price of several commodities exported by developing countries, to expand markets for natural products in relation to synthetics and to promote the processing of raw materials in producer developing countries.

Food

Land in developing countries which is unexploited or underexploited owing to lack of means should be reclaimed and put into practical use. The international community should undertake concrete and speedy measures with a view to arresting desertification, salination, pest damage, or other phenomena involving several developing countries, particularly in Africa. Further deterioration of natural resources and food supplies through pollution is to be prevented. Concrete measures should be taken to increase food production and storage facilities in developing countries by ensuring an increase in all essential inputs from developed countries on favourable terms. Exports of food products of developing countries should be promoted through just and equitable arrangements, including the progressive elimination of such protective and other measures as constitute unfair competition.

General trade

In order to ameliorate the terms of trade of developing countries and eliminate their chronic trade deficits a number of measures should be taken including:

Improvement of access to markets in developed countries;

Expeditious formulation of commodity agreements;

Possible reimbursement by importing developing countries to exporting developing countries of receipts derived from customs duties, taxes and other protective measures applied to imports from the latter countries;

Setting up general principles of pricing policy for exports of commodities of developing countries with a view to rectifying the latter's terms of trade and, pending such rectification, consideration should be given to improving compensatory financing schemes for meeting their development needs;

Implementation, improvement and enlargement of the generalized system of preferences for exports of agricultural primary commodities, manufactures and semi-manufactures from developing to developed countries;

Setting up of buffer stocks within the framework of commodity arrangements and their financing by international financial institutions;

Refraining from new investment for the expansion of the capacity to produce synthetic materials and substitutes in cases where natural materials can satisfy the requirements of the market.

Transportation and insurance

Efforts should be made to promote increasing and equitable participation by developing countries in world shipping, to arrest and reduce freight rates, to minimize the cost of insurance and reinsurance for developing countries and to ensure the early implementation of the code of conduct for liner conferences. Urgent measures should be taken to offset the disadvantages suffered by land-locked countries with regard to transportation and transit cost and by developing island countries.

International monetary system and financing of the development of developing countries

Objectives

The reform of the international monetary system should aim at a number of objectives including:

Checking the inflation experienced by developed countries, preventing it from being transferred to developing countries and mitigating the effects of inflation in developed countries on the economies of developing countries;

Eliminating the instability of the international monetary system, in particular the uncertainty of exchange rates;

Maintenance of the real value of the currency reserves of the developing countries;

Adequate and orderly creation of additional liquidity with particular regard to the needs of the developing countries and early establishment of a link between Special Drawing Rights and additional development financing in the interest of developing countries;

Full and effective participation of developing countries in all phases of decision-making for the formulation of an equitable monetary system;

Promotion of an increasing net transfer of real resources from the developed to the developing countries.

Measures

With a view to attaining the afore-mentioned objectives, a number of measures are recommended including:

Accelerated implementation by developed countries of the programme laid down in the International Development Strategy for the net amount of financial resource transfers to developing countries, and augmentation of the official component of such transfers;

Promotion of foreign investment from developed to developing countries in accordance with the needs and requirements of the countries concerned as determined by them;

Debt renegotiation with a view to concluding agreements on debt cancellation, moratorium, rescheduling or interest subsidization.

Industrialization

Developed countries should respond favourably to the requests of developing countries for financing of industrial projects and should encourage their investors to finance such projects, particularly those which are export-oriented. They should also help to set up in developing countries facilities for processing raw materials and commodities produced by those countries. The international community should continue and expand its technical assistance programmes with emphasis on vocational training and management development of national personnel.

Transfer of technology

An international code of conduct for the transfer of technology, corresponding to needs and conditions in developing countries, should be formulated. Those countries should be given access on improved terms to modern technology and also be given assistance in research and development programmes and in the creation of suitable technology. Commercial practices governing the transfer of technology should be adapted to the developing countries' requirements and the abuse of sellers' rights prevented.

Regulation of and control over the activities of transnational corporations

An international code of conduct should be adopted and implemented with a view *inter alia* to preventing interference in the internal affairs of host countires, regulating their activities so that they conform to those countries' national development plans, regulating the repatriation of profits and promoting reinvestment of those profits in developing countries.

Promotion of co-operation among developing countries

The Programme of Action states that collective self-reliance and growing co-operation among developing countries will further strengthen their role in the new international economic order. With a view to expanding that co-operation developing countries should take further steps designed *inter-alia:*

> To support the establishment and improvement of an appropriate mechanism to defend the prices of their exportable commodities and to improve access to and stabilize markets for them;
>
> To promote, establish or strengthen economic integration at the regional and sub-regional levels;
>
> To increase considerably their imports from other developing countries.

Special Programme

The Programme of Action includes a Special Programme aimed at mitigating the difficulties of the developing countries most seriously affected by economic crises. As part of the Special Programme a Special Fund whose purpose is to provide emergency relief and development assistance has been established under the auspices of the United Nations. The Fund is to be financed through voluntary contributions from industrialized countries and other potential contributors and is to commence operations by 1 January 1975 at the latest. The General Assembly established an *Ad Hoc* Committee on the Special Programme, composed of thirty-six Member States to advise on the scope, machinery and modes of operation of the Fund. The Committee was also instructed to monitor, pending commencement of the Fund's operations, the bilateral and multilateral measures being taken for the most seriously affected countries and to prepare a broad assessment of the difficulties facing those countries and their needs with regard to essential commodities and goods and financial and technical assistance.

The *Ad Hoc* Committee held two sessions. At the end of its second session, it adopted a report, to be submitted to the Economic and Social Council, containing a draft resolution on the provisions to govern the Special Fund and a review of the monitoring of the bilateral and multilateral measures being taken to assist the most seriously affected countries. Concerning the monitoring, the Committee "noted that the effectiveness of the Emergency Operation could be enhanced if a certain volume of resources were channelled through the United Nations. Such resources could be deployed flexibly and expeditiously by the Secretary-General in meeting the objective of General Assembly resolution 3202 (S-VI) and could be used towards balancing any deficiencies in the over-all distribution of resources among recipient countries that might result from the separate decisions of the many bilateral donors'"[1]. The recommendations of the Council in the report will be submitted to the twenty-ninth session of the General Assembly.

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[1] See Report of the *Ad Hoc* Committee on the Special Programme on its second session, E/5590 paragraph 6.

SOME AREAS OF POTENTIAL CONTROVERSY

The following were a few of the points raised in plenary discussion,* mostly by countries with a free market economy.

National sovereignty

The right of a country to exercise permanent sovereignty over its natural resources was recognized, but the implementation of this right should be carried out with due regard for the process of international law.

Trade and development

The question of "producers' associations" aroused some apprehension that it might not be in the real interests of world economy to encourage the formation of what could be regarded as cartels.

The idea of a link between the prices of exports from developing countries and those of imports from developed countries caused varying reactions. Some accepted the implied principle but doubted the technical and practical feasibility. Others were in outright disagreement, stating that no one would gain from promoting unrealistic pricing arrangements.

Discouraging investment in synthetics in favour of natural materials might in some cases be inimical to the needs of economic development.

The idea of formulating new commodity agreements met with some skepticism, although it was agreed that consideration on a case-by-case basis might be possible.

The viability and practicality of reimbursing receipts from customs duties was questioned.

There was some lack of support for setting up general principles for a pricing policy on the grounds that this is already under consideration within competent international bodies.

With regard to preferential treatment in multilateral trade negotiations between developed and developing countries, it was suggested that the appropriate wording in the 1973 Tokyo Declaration should provide guidance.

Transportation and insurance

The promotion of equitable participation in world shipping should not be at the expense of free competition in the international freight market. It would not be easy to bring influence to bear to reduce freight rates and insurance costs.

Although it was suggested that the Code of Conduct for Liner Conferences should be considered at the twenty-ninth session of the General Assembly, other delegates felt that it would not be acceptable to be involved in subsidizing shipping and that the Convention could in fact lead to higher freight rates and inefficiency.

Reform of the international monetary system

This had already been discussed at the twenty-eight session of the General Assembly, resulting in resolution 3084. One should not anticipate the further decisions which would be made by the appropriate international bodies.

There should be measures to check inflation, but they must be taken on a world-wide basis, not in isolation. Remedies to maintain the real value of currency reserves had not so far proved effective.

With regard to changes in the voting patterns within international monetary systems, it was mentioned that the international bodies involved were in the process of reviewing the formula for establishing quotas.

Any changes in the allocation of Special Drawing Rights based on a revised concept of world liquidity must be based on criteria related to world stability and to world-wide needs in liquidity.

The question of renegotiating debts might give rise to a tendency to try to ensure an automatic refinancing of debts.

Transfer of technology

The term "code of conduct" might be considered to prejudge the results of work currently underway in other organs of the UN; "directives" might be preferable.

It would be unacceptable for commercial transfer of technology to be carried out on terms inconsistent with normal commercial practices.

Regulation of transnational corporations

UN studies dealing with this matter were underway, and the formulation of positions should be reserved pending their publication.

*Provisional Verbatim Records of the Two Thousand Two Hundred and Twenty-ninth, Thirtieth, and Thirty-first Meetings of the General Assembly during its sixth special session (A/PV.2229, 2230, 2231, 1 and 2 May 1974).

. . . And Summing Up

H. E. Mr. Fereydoun Hoveyda

Permanent Representative of Iran to the United Nations

The most striking result of the sixth special session of the General Assembly rests perhaps in the fact that it demonstrated clearly the essential truth of our time that no country or group of countries can henceforth unilaterally decide the fate of the planet as a whole. It also served to emphasize the fundamental interdependence which from now on binds together all nations. Finally it underlined the fact that, over and above the economic convulsions which have overtaken the advanced regions of the world in particular, the basic problem remains that of the widening gulf between the industrialized and the developing countries.

The ideas which emerge explicitly or implicitly from the Establishment of a New Economic Order and Programme of Action, adopted last May, are only a reflection of the directions taken by the current evolution. Despite their imperfections, the two documents constitute an acceptable basis for a continuous and expanded dialogue between the advanced nations and the others.

It has been said that the Declaration and the Programme have ignored the difficulties of the advanced economies. But let us not forget that the theme of the session was confined solely to the problems of natural resources and development. There was no question of investigating the global economic situation, but only of drawing attention to what was probably the most serious aspect of the disequilibrium.

The developing countries are fully aware of the other problems of the world economy, and, at the special session on development and economic co-operation to be held in September 1975 there will be many chances to examine them.

No one today disputes the need for a fundamental revision of the outworn concepts and practices which underpin the international economic system. There are many attempts here and there to sketch out models which are more in tune with the present needs of our world. What is important is to avoid falling into the errors of the past. The new international economic order will be the *collaborative work of all nations* or it will not be at all. The stake is so formidable and the situation so serious that we cannot rely on partial measures. The patching up of a moribund system, already deeply resented by the non-industrialized countries because of its injustices, cannot hold out for long against the thrust of needs which are becoming more urgent. It is very understandable that the nations which have been dominant for so long do not accept light-heartedly the crumbling away of their centuries-old privileges. The others, equally understandably, refuse to continue to accept the consequences of an order which has continually impoverished them. The debate is becoming more bitter just when dialogue and co-operation appear to be more necessary than ever. All of us must undertake to keep the lines open.

It is obvious that the establishment of a new order implies structural changes. It is clear that the disappearance of exorbitant inequalities requires readjustments. It is self-evident that all those who can afford it must aid those who have nothing. The Cassandras, as always, are spreading a dangerous pessimism under the cover of apparent realism.

Happily they are mistaken. The very fact that a special session of the General Assembly was able in 1974 to devote itself to the problems of natural resources and development is already remarkable in itself. Even more, since last May the oil-producing nations have proclaimed their desire to help others. Several of them have expanded, in a way unequaled in the past, their bilateral and multilateral assistance. Some industrialized countries, despite current difficulties, have increased their programmes for developing countries. These are reassuring signs that cannot be ignored.

As for the international community, operating within the United Nations system, it must encourage these trends and multiply the efforts to facilitate the setting up of an economic order based on equity, sovereign equality, interdependence, common interest and co-operation among all states, big and small, rich and poor.

The next special session on development and economic co-operation will provide a unique occasion for a giant stride ahead. Let us hope that the members of our organization do not let it slip by and that during the intervening months some of the reservations which marked the adoption of the documents of the sixth special session will have been dissipated. All of us must work towards a consensus reflecting the unanimous will of the inhabitants of our globe.

PHOTO A: Ambassador Hoveyda, Chairman of the Ad Hoc Committee, with Diego Cordovez, Secretary of ECOSOC, conferring with Ambassadors Mojsov of Yugoslavia and Sen of India.

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Principles and Problems of National Science Policies. No. 5, Paris 1967.

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UNISIST — World Science Information System (UNESCO)

Study Report on the Feasibility of a World Science Information System. SC.70/D.75/A, Paris 1971.

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Forthcoming from UNITAR:

- Deputy Executive Director and Director of Studies, Oscar Schachter, is preparing a series of studies on Equitable Sharing of World Resources which will be published as a book in 1975.
- A book-length report entitled **Brain Drain and Study Abroad**, based on multinational comparative research, will be published in 1975. The author is Dr. W. Glaser, a UNITAR consultant who headed the research project.
- Guidelines for Establishing the Economic Effects of Multinational Firms is the title of a project initiated by Alexandr Mironov, Deputy Director of Studies.
- Research is being carried out on the settlement of disputes related to ocean resources and to environmental matters.

UNITAR Activities

Recent and Forthcoming Publications

The OAS and the UN: Relations in the Peace and Security Field (RS/4; PS/7)
  Aida Luisa Levin
  (English and Spanish editions)

Relations Between the OAU and the United Nations (RS/2)
  Berhanykun Andemicael

The Making of the Manager: A World View (ST/10)
  ed. Sidney Mailick

The Search for New Methods of Technical Cooperation (CR/4)
  Harold Caustin

Education for General Management: The The Staff College Approach (ST/12)
  ed. Morris L. Brodie and
  E. Andrew Life

African International Legal History (ST/9)
  A. K. Mensah-Brown

Tendencias del Derecho del Mar Contemporaneo (LS/5S)
  ed. by F. Orrego Vicuna
  (Spanish only)

El Peru de las Tres Razas (ST/11S)
  J. Matos-Mar
  (Spanish only)

International Navigable Waterways: Financial, Legal and Institutional Aspects (ST/6)
  ed. Guillermo Cano
  (English and Spanish editions)

The Ways of the Peacemaker
  K. Venkata Raman

The United Nations, Energy and Raw Materials:
Report of the Third UNITAR Seminar for UN Officials held at Schloss Hernstein, Austria; 19-21 June 1974.

International Procurement (UNITAR/MAN/3
  Gosta Westring

The United Nations System: Problems of Order, Coherence and Co-ordination
  Martin Hill

UNITAR TRAINING PROGRAMME

(Provisional)

Calendar, September 1974 - September 1975

NOTE: This is a partial calendar of UNITAR training events for this period. The re-establishment of the Training Department, the planned extension of the Geneva-based training programme, negotiations in progress with the UN Secretariat and specialized agencies concerning collaborative training activities in the coming year, and a plan to press on with additional programming on a regional basis which is largely dependent on special funding, all combine to make the following list a necessarily tentative one. It is UNITAR's basic training programme for this period. Some of the items require more planning, further precision. Some will probably be expanded. Some, inevitably, will have to be postponed or stopped and other opportunities will present themselves in the course of the year.

1974	
September	
5-7	Course for Venezuelan Foreign Service Officers (New York)
5-6; 9-10; 11-12	Course on UN Documentation (New York)
18-20	Seminar for New Delegates to the General Assembly (New York)
October 1-3	Seminar on United Nations Documentation (Geneva)
November 11-29	Course for Mexican Foreign Service Officers (New York)
December 2-6	Seminar on Decision-Making Procedures in the United Nations for newly arrived members of missions (Geneva)
1975	
January 16-29	Refresher couse in International Law (Kinshasa, Zaire)
February	Course on United Nations Documentation (New York)
	Course on United Nations Documentation (Geneva)
	Seminar on UN and Outer Space Technology (New York)
3-15	Refresher course in International Law (Freetown, Sierra Leone)
March	Seminar on Science and Technology for Development (Geneva)
	Seminar on Science and Technology for Development (New York)
	First Seminar for International Women's Year (New York)
April	Advanced Course on International Documentation (Geneva)
	Colloquium on Multilateral Diplomacy for members of missions (New York)
	Seminar on United Nations and Population Issues (New York)
	Training Course on the Making of a Resolution (New York)
May	Second Seminar on Co-ordination in the UN System (New York and Geneva)
	Second seminar for International Women's Year (Uppsala, Sweden)
July	UNITAR Seminar for Senior UN Officials (Schloss Hernstein, Austria)
August	Seminar on issues before the Seventh Special Session of General Assembly (New York)
	Seminar for New Delegates to the General Assembly (New York)

Study and exploration are under way on the prospect for increased training activity at the regional level, specifically in diplomatic training and in a substantive area of current UN concern, science and technology for development. Consideration is also being given to the development of a training function in relation to forthcoming international conferences.

UNITAR

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The two functions of the Institute are training and research.

The Institute provides training at various levels to persons, particularly from developing countries, for assignments within the United Nations system or with national services connected with the work of the UN. These programmes include training for UN staff members.

The Institute conducts research and study related to the functions and objectives of the United Nations. Such research and study give appropriate priority to the requirements of the Secretary-General and of other UN organs and Specialized Agencies.

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